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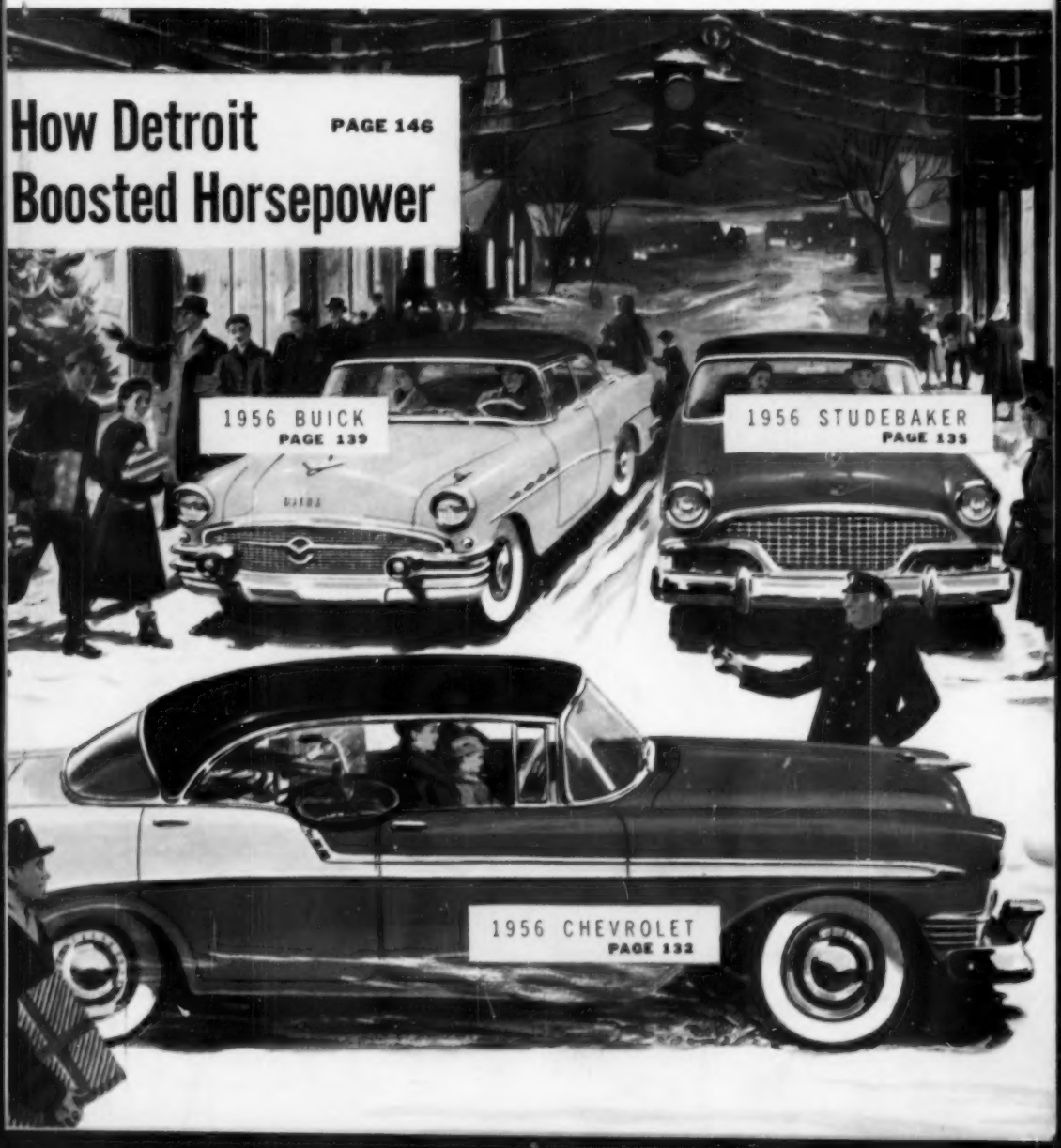
POPULAR SCIENCE

December 35c MONTHLY



Cannot channel

Easy to clean

Filters out all dirt

Traps moisture

Never needs replacing

Reduces friction

Save Oil and Money with the New *Micro* BRONZE

PERMANENT ALL-METAL FILTER

Rigid double-cone construction

Increases engine life

Waterproof

Saves detergents

Saves engine repairs

Unaffected by pressure

Unconditionally guaranteed

Screens out abrasives

Easy to install

Efficient at all temperatures

Saves oil

Fits all cars

All-metal construction

Eliminates acid

Built-in acid neutralizer

1. Eliminates Engine Acids
2. Traps Damaging Moisture
3. Filters all the Dirt
4. Reduces Friction
5. Saves the Detergents

U. S. Patent App. No. 464408

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DOES YOUR PRESENT FILTER PASS THE "ACID" TEST? If you have a Micro Bronze Filter with the built-in Acid Neutralizer your engine is getting the full protection it needs! In a simple test you can easily make yourself, the Micro Bronze special element completely neutralizes acids in 60 seconds!

BUILT-IN ACID NEUTRALIZER!

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FITS EVERY CAR & LIGHT TRUCK. A Micro Bronze Unit costs only $6.95, *(including all full-flow models.* Easy to install, never needs changing. Micro Bronze Filter Housing $9.95 for all cars with no filter equipment (does not include element). Use the easy-order coupon now.

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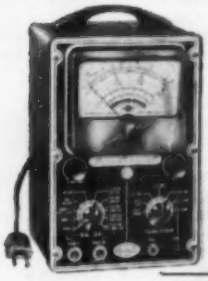
FOR REPAIRING RADIO AND TV

The New Model 670-A

SUPER METER



A COMBINATION

VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

ADDED FEATURE:
Built in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

SPECIFICATIONS:

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A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
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The Model 670-A comes housed, in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

28.40

The new streamlined model TC-55

TUBE TESTER

QUICKLY AND EFFICIENTLY TESTS RADIO AND TV TUBES INCLUDING: SEVEN PIN MINIATURES; EIGHT PIN SUBMINARS, OCTALS AND LOCTALS; NINE PIN NOVALS

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The Model TC-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap."

CHECKS FOR SHORTS AND LEAKAGES BETWEEN ALL ELEMENTS.
The Model TC-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

ELEMENTAL SWITCHES ARE NUMBERED IN STRICT ACCORDANCE WITH R.M.A. SPECIFICATION.
One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system.

Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

The Model TC-55 comes complete with operating instructions and charts. Use it on the bench—use it for field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions.

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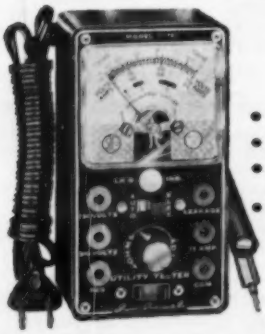
FOR REPAIRING ALL ELECTRICAL APPLIANCES MOTORS AND AUTOMOBILES

The New Model 70 UTILITY TESTER



As an electrical trouble shooter the Model-70:

- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, etc.
- Will measure current consumption *while the appliance under test is in operation.*
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).
  - Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Fans, Switches, Thermostats, etc.

As an Automotive Tester the Model 70 will test:

- Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.

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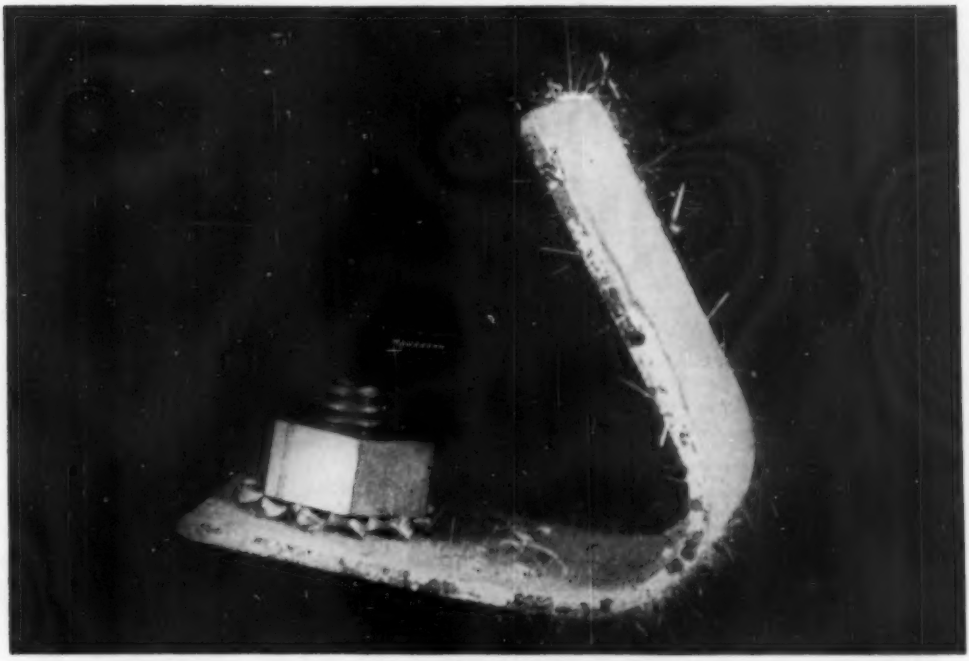

Whiskers on tin-plated steel, enlarged 6 times. Immense yield strength of metals in whisker form was discovered by Bell scientists.

The clue of the metal whiskers

The habit of close observation at Bell Laboratories often turns "tremendous trifles" into important scientific progress. Such a case occurred when unexplained short circuits in wave filters seemed to be associated with a small zinc-plated mounting bracket.

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The scientists studied the whiskers, grew larger ones, and showed that the crystals had enormously high yield strength as predicted by the theory for perfect crystals – a strength far greater than for the same metal in any other known form. This clue has opened new frontiers in the study of what makes metals strong or weak, and has excited metallurgists all over the world.

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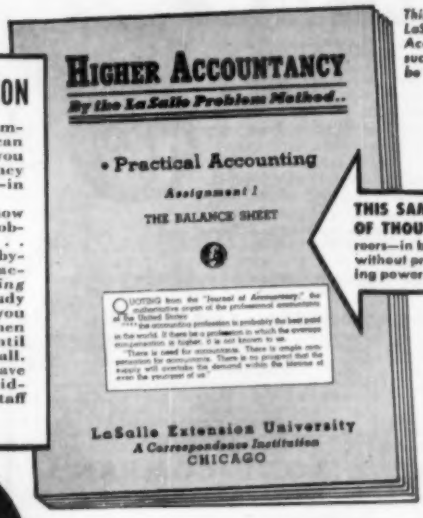

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Letters—

Nothing's Safe in A-War

I'm one of the "45,000 people living within five miles" of the atomic power plant they're building for New York City [Aug., p. 82], so I was interested in your remarks about its safety. You said it can't blow up. But suppose somebody blows it up? Mightn't an enemy bombing attack shower the landscape with murderously hot water, uranium, thorium and who-knows-what?

SIDNEY ERSKEN, Peekskill, N.Y.

Old-fashioned high-explosive bombs aren't likely to cause much harm, since the furnace building is reasonably bombproof. If an A- or H-bomb hit, the bomb itself would spew so much radiation that the small extra amount from the destroyed power reactor would hardly be noticeable.

That $1,300 Helicopter

Where can I get that $1,300 helicopter pictured in your September issue [p. 169]?

P. R. GRAHAM, Mt. Clare, W. Va.

It's an experimental model designed in Italy and not yet—unfortunately, to judge from the many inquiries we received—in production.

6 Volts From 12?

Glen Connor's extra battery for operating a 6-volt radio on a 12-volt car system [PSM, Oct., p. 193] is expensive and unnecessary. A direct hookup to three of the six battery cells works fine in my car.

J. C. GRADY, Kenly, N.C.

I use a 6-volt radio on my 12-volt car system by putting a 10-ohm, 50-watt resistor in series with it.

ROBERT D. BURK, Dayton

You can get 6 volts from a 12-volt car battery without spending a cent. Drill a hole

Leo Kerber, Shakopee, Minn. "Awhile ago I tried for one of these scholarships. I didn't think my sketch could win, but it did! I've learned a lot from the art course—and have already sold quite a bit of my work."

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in the middle strap and insert a self-tapping screw. I did this to get juice for a 6-volt fan and it works fine.

J. Foster Bailey, Baltimore

Several readers have suggested these two methods. Some overlook the fact that the two-way radio specified in the article, having a transmitter, takes far more current than the ordinary car radio.

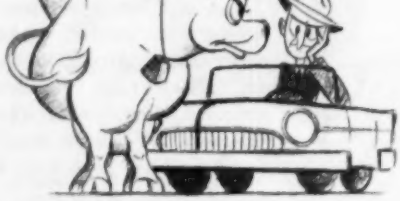
Most of today's 12-volt batteries have internal straps, which cannot be tapped. Where tapping off 6 volts is feasible, it may serve for such light accessories as fans. But according to Chrysler engineers, experiments show that drawing any considerable current from half the cells creates an unbalanced condition that can be very harmful to the battery.

A voltage-dropping resistor is a current waster, dissipating energy as heat. In reducing 12 volts to 6, half the current used is thrown away. This may be unimportant in running a fan, but serious with heavy equipment. A resistor also introduces poor voltage regulation, which is especially detrimental in a transmitting rig.

To Honk or Not to . . .

I agree with Mr. Winstead in your October letters column: Horn blowing startles many a pedestrian into doing the wrong thing. A sudden blast may easily confuse him into jumping out of the path of one car into the path of another.

Horns frighten animals into doing the same thing. Yet if a cow (cattle have the right of way the same as trains) happens



to be in your way, you can blow your battery down and it won't do any good if she takes a notion not to move.

Alice Goodenow, Eloise, Mich.

I'm for keeping horns.

A pedestrian once walked into the side of my car while reading a paper held in front of his face. Fortunately, he was not injured. I should have touched the horn button but

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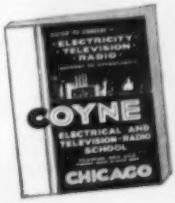

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never dreamed he would continue right across the highway from the sidewalk without looking.

W. B. Spears, Ecorse, Mich.

Cars Give Him a Headache

Seat belts and dashboard padding are fine things, but I wish the Detroit wizards would turn their genius to a more homely kind of safety and protect my old skull from those mole tunnels they laughingly call doors. I long ago gave up wearing a hat in the car, since it got knocked into the gutter every

time I climbed in. But I may go back to wearing one again—a miner's safety helmet.

Dick O'Hara, Des Moines

Car Trunks Have Drains, But . . .

Most cars already have the trunk drainage vents that Donald Lovelady asked for in "I'd Like to See Them Make" [Aug., p. 113]. There is a rubber plug that pulls out so you can wash and drain the trunk.

Cpl. T. A. Cook, Ft. Ord, Calif.

Those little holes in the spare-tire pit make a trunk-cleaning job possible but not easy. You have to remove the tire, remove the plugs, and then swish furiously to get the water into the pit.

Where Does Space Begin?

At 200 to 300 miles above the earth, you say, our projected artificial satellite will travel "in the vacuumlike region of true space" [Sept., p. 130]. Just what is "true space" and how far from earth does it begin?

K. H. Howard, Cambridge, Mass.

"Space-equivalent" conditions, says Dr. H. Strugold, USAF space-medicine expert, are encountered with respect to lack of oxygen at 52,000 feet; boiling of body fluid at 65,000 feet; heavy cosmic radiation at 120,000 feet; ultraviolet solar radiation at 135,000 feet, appearance of black sky at 400,000 feet; meteorites at 500,000 feet, or about 95 miles, which may be considered just about the top of this "stairway to space."

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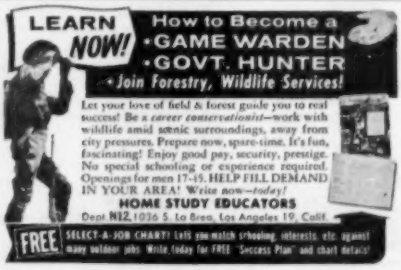

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700-16	5.75	760-15	5.45	825-15	12.95	825x20	16.65
750-16 (6)	8.85	800-15	5.75	600-20	8.05	900-20	15.55
550-18	4.55	820-15	5.75	650-20	8.35	1000-20	15.75
550-17	4.55	670-16	5.35	32x6 (8)	11.05	1100-20	17.45
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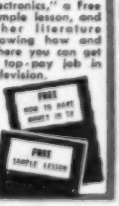

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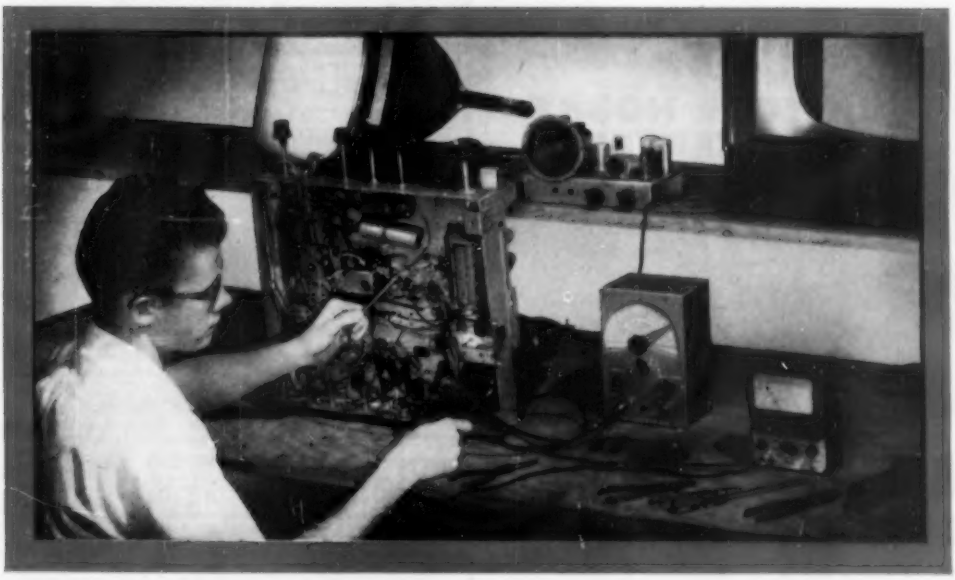

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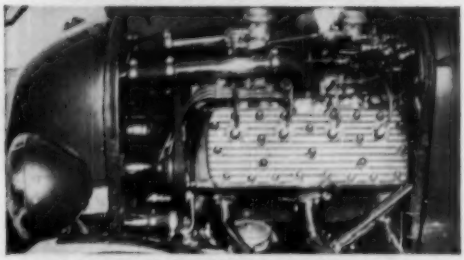

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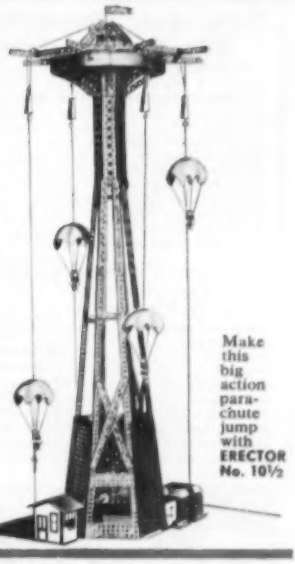

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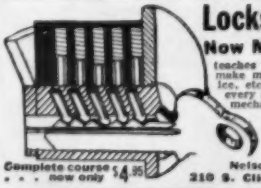

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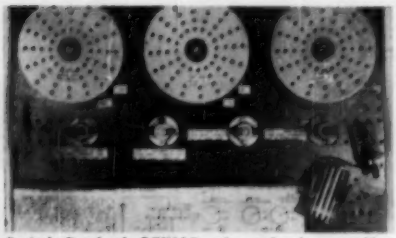

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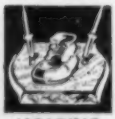

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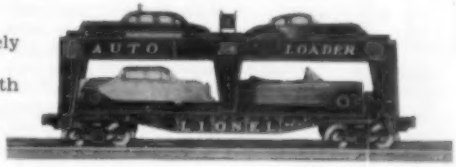

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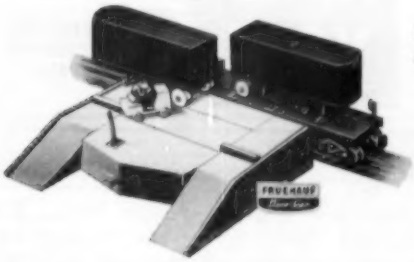

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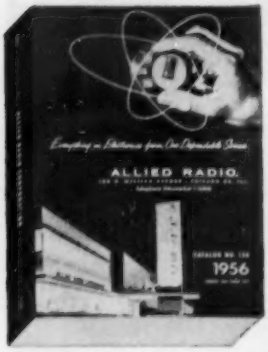

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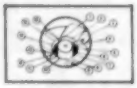

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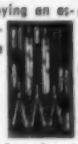

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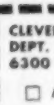

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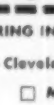

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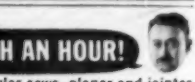

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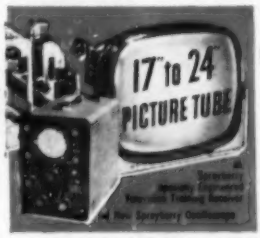

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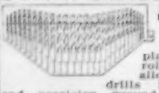

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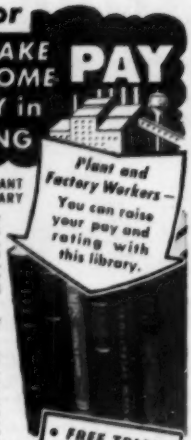

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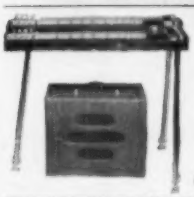

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36 RADIO, TELEVISION, SUPPLIES & EQUIPMENT

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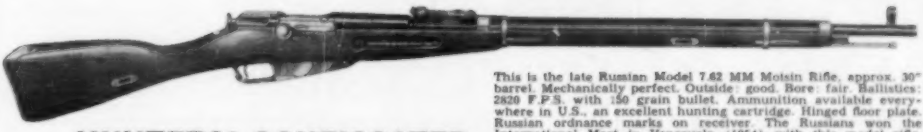

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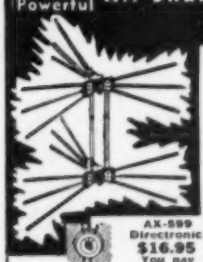

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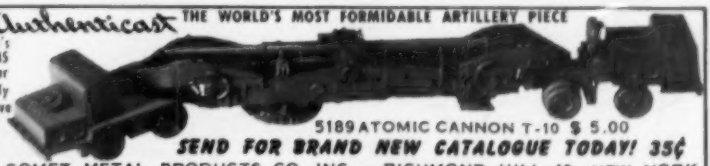

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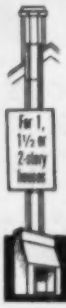

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Props Made from Magnesium. A craftsman who builds 1½-hp. hydroplane units for sportsmen, Lee Renard of Utica, Ohio, found wooden propellers slow to turn out and balance. Now he saves time by bandsawing prop blanks from magnesium plate. Given a 10° twist and finished with a disk sander and buffing wheel, they're light, strong and practically vibration-free. At 2,000 r.p.m., they give a flat-bottomed boat a speed of from six to eight miles an hour.

Model Jeeps Run on Back-Yard Track. Juvenile traffic is heavy in Moose Jaw, Sask., when C. F. Wilson starts up the 5-hp. gasoline engine that hauls these midget jeeps around a 10′-by14′ outdoor oval track. An endless chain recessed in the platform's center slot provides the power link for his popular basement-built kiddies' ride.

Midget Shovel Scoops Up Orders. To demonstrate the performance of its latest electric power shovel at trade shows and conventions, Bucyrus-Erie has just built this 381-pound model of the huge earth mover. A full-size shovel control panel puts the one-twelfth-scale midget through every maneuver that is engineered into the big machine.

Cadillac of Tugboat Models. Seven feet long and weighing 65 pounds without ballast, this finely detailed model of a Great Lakes tug churns through the water at better than five knots, driven by a one-cylinder steam engine working at 125 pounds' pressure. General Motors' Cadillac Division power engineer Ray Tarenski spent eight months building the aluminum hull, the engine and the superstructure from scratch. The boiler is fired by a blowtorch under air pressure.

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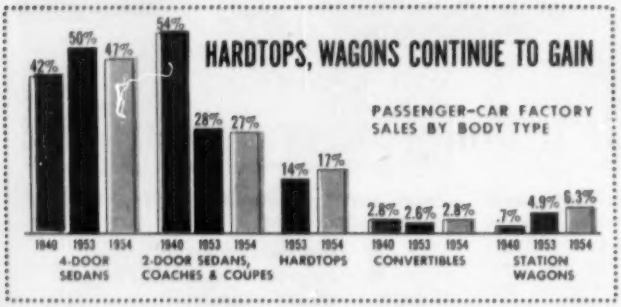
POPULAR SCIENCE MONTHLY

LATE NEWS...

Work on a tamed H-bomb for generating electricity is already under way at five U.S. laboratories: Princeton, NYU, Los Alamos, Oak Ridge and Livermore. The obvious difficulties involved in operating such a miniature sun on earth--controlling its 100,000,000° heat and avoiding an explosion--seem to have been licked, the Atomic Energy Commission indicates without explaining how. The problem now, the scientists say, is getting more power out than must be put in to keep the reaction going.

They're building the "moons" that Project Vanguard will fire into space in '57 or '58. The contract for the first "bird" went to Glenn L. Martin Co., which makes the Navy's Viking rockets. General Electric will build the first-stage rocket motor.



Automobile Manufacturers Association

Electric door locks are Detroit's latest safety idea. They would keep car doors shut until you pushed a button on the dash. At least one maker is expected to introduce them soon . . . THE AAA IS CHEERING ON the auto safety race. The Association urged manufacturers "to tone down their emphasis on horsepower and devote more thought to ways of protecting the driver."

The victory over polio seemed secure this fall. Some 7,000,000 children got Salk shots. They contracted 25 to 50 percent less polio than unvaccinated youngsters.

Pilots understand radio messages better, especially when there is static, if the speaker stutters. "Wuh-one, tuh-two" is clearer than "one, two." Ohio State researchers also found that a kind of electronic stuttering increases clarity. This they call "delayed hearing." It involves feeding the sound to one of the hearer's ears a fraction of a second after it is fed to the other ear.

Antibiotics may soon preserve food as well as cure disease and fatten livestock. A dash of Terramycin keeps milk fresh for weeks, and doubles the shelf life of salad greens.

Research rockets will be caught on the fly if an Australian scheme works out. The rockets have parachutes to lower them back to earth, but are often damaged by bumpy landings. To catch them in the air, a pilot will tow a line having grapnels, maneuvering so that his grapnels hook a line trailing from each rocket's parachute. The pilot will then fly down a gully spanned by cables and transfer his catch to these cables.

New book. The universe according to Hoyle (Cambridge University's Fred Hoyle, that is) gets a sprightly treatment in *Frontiers of Astronomy* (Harper & Brothers, New York, $2.50). Hoyle explains everything from the center of the earth to the farthest stars. Illustrations are outstanding.

THE FABULOUS '56 PONTIAC WITH A BIG AND VITAL GENERAL MOTORS "AUTOMOTIVE FIRST"!

Believe us—it isn't easy to impress a test driver!

But they're cheering Pontiac in a big way.

What's set them buzzing is that big and vital General Motors "First" combining:

Pontiac's new big-bore Strato-Streak V-8 with the terrific thrust of 227 horsepower.

General Motors' new Strato-Flight Hydra-Matic that gentles this mighty "go" to smoothness beyond belief.*

You don't need a test track to prove that here is the lift of a lifetime.

Traffic tells you. Here's "stop-and-go" response as fast as thought itself. *A hill helps.* High or low, it's left behind without a sign of effort. *And passing definitely pins it down.* Gun it and instant, flashing power sweeps you swiftly by the loitering car ahead. No drag, no lag—just safe and certain "go"!

There's plenty more to charm you. The safety of big new brakes, a steady ride, advanced controls. Glamorous new beauty.

But, above all, it's that fabulous new "go" that gets you!

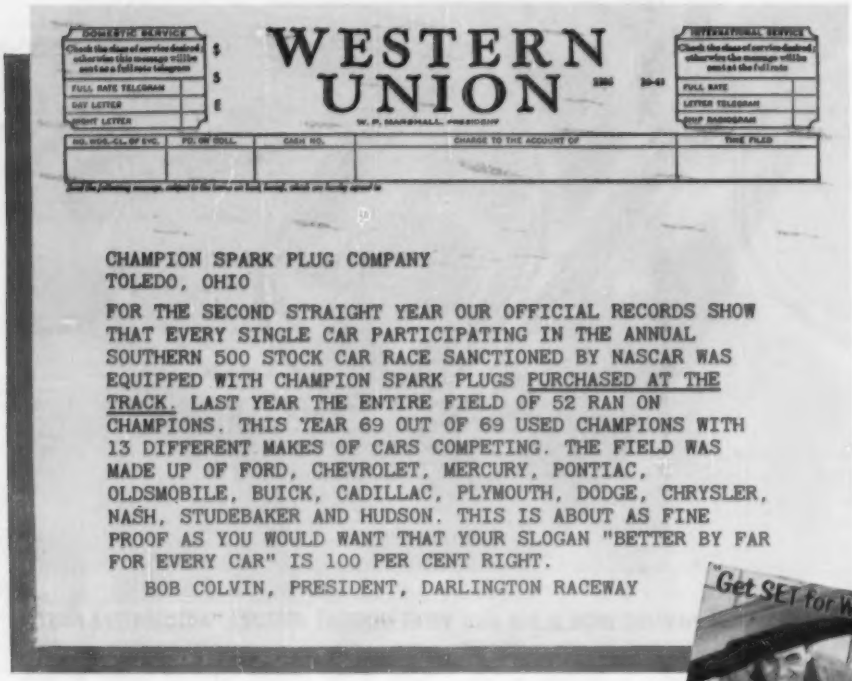
Drive a Pontiac today for a glorious double thrill. There'll be pride in your heart, a torrent at your toe-tip. What more could anyone want?

**An extra cost option*

'56 PONTIAC

PONTIAC MOTOR DIVISION OF GENERAL MOTORS CORPORATION

If you drive one of these cars . . . BUICK, CADILLAC, CHEVROLET, CHRYSLER, DODGE, FORD, HUDSON, MERCURY, NASH, OLDSMOBILE, PLYMOUTH, PONTIAC, STUDEBAKER, ***here's a sure-fire way to get all the horsepower and performance you paid for!***



WESTERN UNION

CHAMPION SPARK PLUG COMPANY
TOLEDO, OHIO

FOR THE SECOND STRAIGHT YEAR OUR OFFICIAL RECORDS SHOW THAT EVERY SINGLE CAR PARTICIPATING IN THE ANNUAL SOUTHERN 500 STOCK CAR RACE SANCTIONED BY NASCAR WAS EQUIPPED WITH CHAMPION SPARK PLUGS PURCHASED AT THE TRACK. LAST YEAR THE ENTIRE FIELD OF 52 RAN ON CHAMPIONS. THIS YEAR 69 OUT OF 69 USED CHAMPIONS WITH 13 DIFFERENT MAKES OF CARS COMPETING. THE FIELD WAS MADE UP OF FORD, CHEVROLET, MERCURY, PONTIAC, OLDSMOBILE, BUICK, CADILLAC, PLYMOUTH, DODGE, CHRYSLER, NASH, STUDEBAKER AND HUDSON. THIS IS ABOUT AS FINE PROOF AS YOU WOULD WANT THAT YOUR SLOGAN "BETTER BY FAR FOR EVERY CAR" IS 100 PER CENT RIGHT.

BOB COLVIN, PRESIDENT, DARLINGTON RACEWAY

Why settle for claims when it's *results* you want from spark plugs! Claims didn't count at Darlington when all stock cars in the classic Southern "500"—*cars exactly like yours*—were tuned to razor-sharp perfection by the nation's best mechanics.

Only *results* pay off—so full-firing, 5-rib Champions were installed in every car which did not already have them for extra horsepower and performance.

Give *your* car a chance to show what it can do. You're paying for top performance. Get it with Champions!

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Any car is better with 5-rib Champion Spark Plugs!

Will tomorrow's home have plastic walls and roof? This house in Texas, which does, may point the way.

He Built His House of Foam

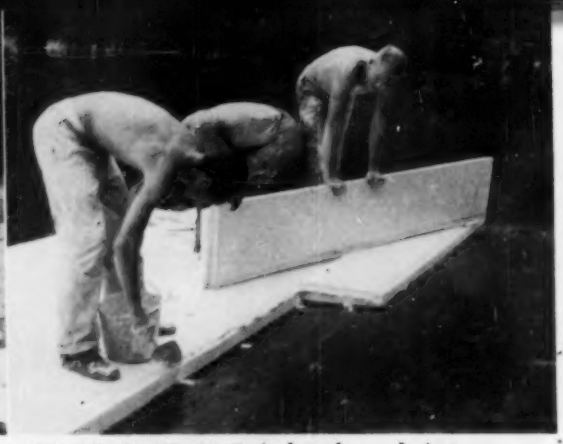
THE snowlike foamed plastic you see in window displays is probably the last material that you'd expect to use to build a house. But that's exactly what was used to make the load-bearing walls and roof of a handsome new home in Houston, Tex.

The owner, Dean Emerson, thought of building with Styrofoam because he is a wholesale distributor of the stuff. But no contractor would touch the job. So Emerson went ahead and started building the house himself. When he moves in next month, he will have a better than ordinary house, and one that cost him about 15 percent less money.

The Emerson house may well mark a turning point in the venerable art of home building. It is one of the first meant-to-be-lived-in dwellings to rely on plastic for structural strength. The plastic

IT'S NO FEAT for Dean Emerson to lift a slab of the plastic used to build his house. Piece nine feet long weighs only 4½ pounds.

PUSH BOX SPREADS CEMENT over plastic slabs to make them rigid. These are roof shingles, cut to shape from standard rectangular slabs. Note flexibility of uncoated slabs (background).



YOU CAN STAND ON IT. And workmen do just that as they lay roof shingles in mortar. Under shingles is a tarred wooden deck. Emerson says that you could build a bonfire on his roof.

here is not decoration or window glazing. It holds the roof up and keeps the rain out. You can't see any of the plastic—it is all covered with cement or plaster—and the house looks like a conventional stucco job.

Styrofoam is mostly air: a moderately hard block of foamed polystyrene plastic. It sparkles so prettily and shapes so easily that it is widely used for florists' displays and store-window decorations. One of the best low-temperature insulations, it is also waterproof, a good vapor barrier, fire resistant, and distasteful to bugs and rats.

How to make it strong. Houston engineer Francis J. Niven figured that out. He stacked the plastic slabs like logs—no mortar, just mastic between vertical joints only. Then he tied the stack on both sides with steel wire strung between a timber plate and the concrete slab foundation, applying tension that practically welded the individual slabs to-

SPRAYED-ON CONCRETE an inch thick makes outside layer of walls. Note the tensioning wires, which contribute much to strength, on unsprayed part. Interior is sprayed with an inch of plaster to make a standard five-inch-thick wall.

TEST BUILDING, put up two years ago, proved durability of plastic construction. The building will be used as a guest house now.

EASY CUTTING, with saw or knife, makes construction go fast. To make room for pipes or wires in solid exterior walls, workmen scratch a groove of the right depth with a knife.

gether. Finally he sprayed an inch of concrete on the exterior and an inch of plaster on the interior. The rough plastic surface bonds to the concrete and plaster better than lath would, making a solid sandwich five inches thick. Result: a wall with twice the compressive strength that the building code requires and one that could stand up to a 200-mile-an-hour hurricane.

That's how the walls of the Emerson house are built. Emerson figures he saved 10 percent on wall cost, largely because Styrofoam is so light in weight and easy to cut that the work went fast. With the assembly-line methods that a builder would employ on development houses, the new method should prove to be still more economical.

A big saving came from Styrofoam's insulating effectiveness. This made possible heating and air-conditioning units a third smaller than a conventional house of the same size would require.

The roof is also Styrofoam, laid as shingles in mortar over a built-up deck of wood, tar and felt. A flat Styrofoam roof would have been simpler and cheaper, requiring no shaping of the plastic slabs and no deck underneath them. But Mrs. Emerson doesn't like the looks of a flat-roofed house.

In one room where Emerson wanted a marble floor, the subflooring is Styrofoam. Over the plastic, thin marble tiles safely support a grand piano. END

Solar Heat Melts Minerals

VAPORIZING diamonds, melting granite or burning holes in zircon takes only a few seconds in a solar furnace adapted from a surplus Army searchlight by a Fordham University scientist. Its 60-inch mirror focuses the sun's rays to create temperatures above 9,000 degrees.

Warm Hands Take Cold Cash

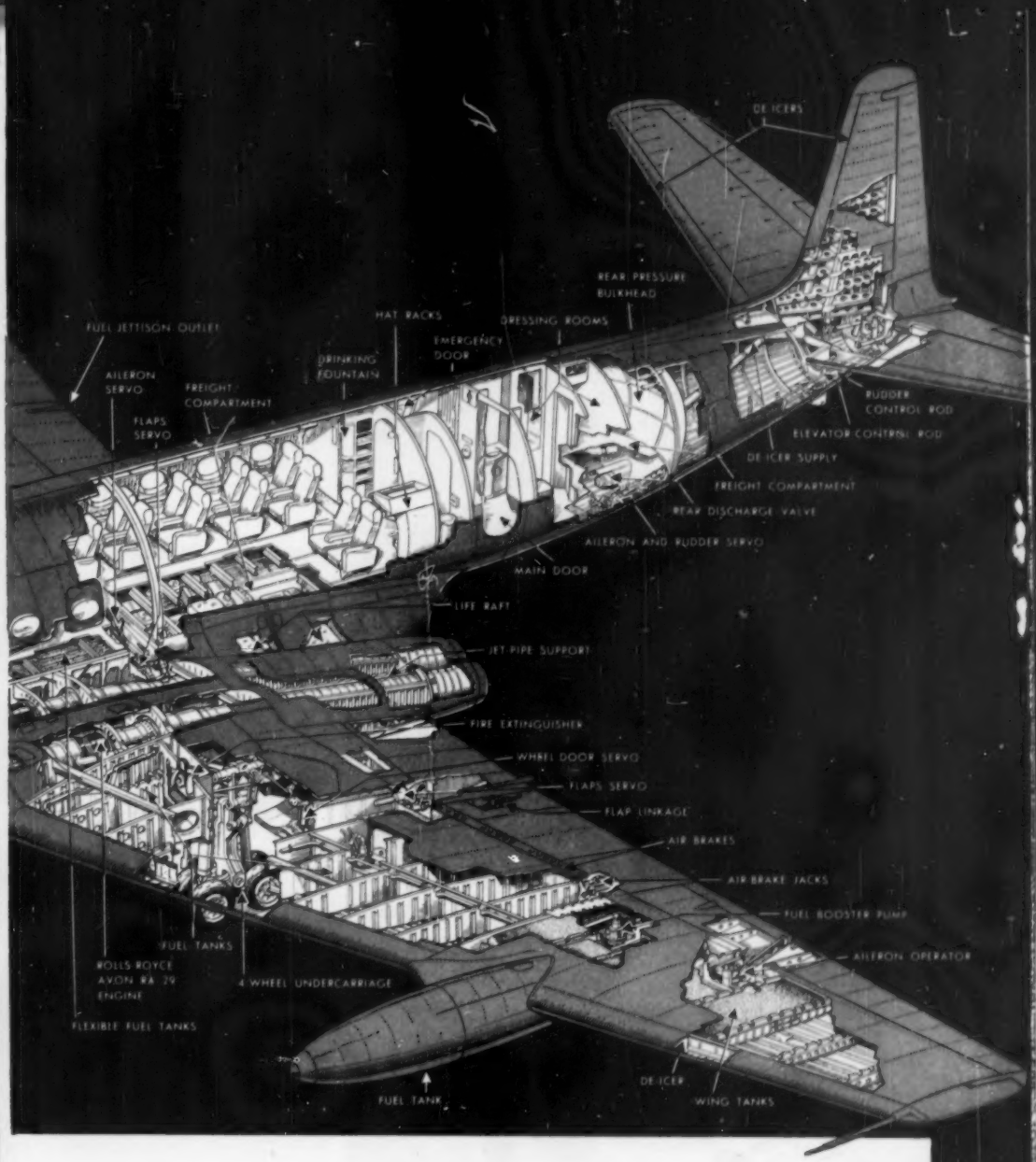
FINGERLESS gloves, necessary for making change, are little protection for toll collectors when it's cold outside. This hand warmer—a section of pipe containing a heating element—solves the problem at the Benjamin Franklin Bridge connecting Philadelphia with Camden, N. J.

New Comet Designed to Cruise at 500 M.P.H.

With this aircraft nowhere on earth will involve a journey of more than 36 hours.

NEW YORK to San Francisco in nearly an hour less than you could now fly from New York to Denver. Not in an Air Force plane, but in a commercial airliner seating 76 people.

That's what Britain's newest jet transport, the Comet Mark IV, is being designed to do. Its four Rolls-Royce Avon engines will whip it through high altitudes at 500-mile-an-hour cruising speeds. No fuel-gulpers, they will permit 3,000-mile nonstop flights: across the U.S., Vancouver to Honolulu, London to Dakar.



De Havilland's new Mark IV is a larger, improved version of earlier Comets that enjoyed brief popularity on Europe-Africa-Asia runs. Their jet engines made them fast, smooth and quiet. But a series of tragic crashes that were later traced to metal fatigue grounded those original jet airliners.

Now British hopes for leadership in civilian aircraft are tied to the Mark IV. Its builders expect it to be flying passengers before U.S.-made jet airliners—the Boeing 707 and Douglas DC-8—get into service in 1958-59.

New Solder May Cut Cost Of TV Tubes

A LOW-TEMPERATURE glass solder for sealing the face on color-TV picture tubes may make assembly quick and economical.

Elements are put in through the face, instead of the neck. The Owens-Illinois solder is then applied and the clamped face sealed on in an oven.

Missouri Bridge Named Year's Handsomest

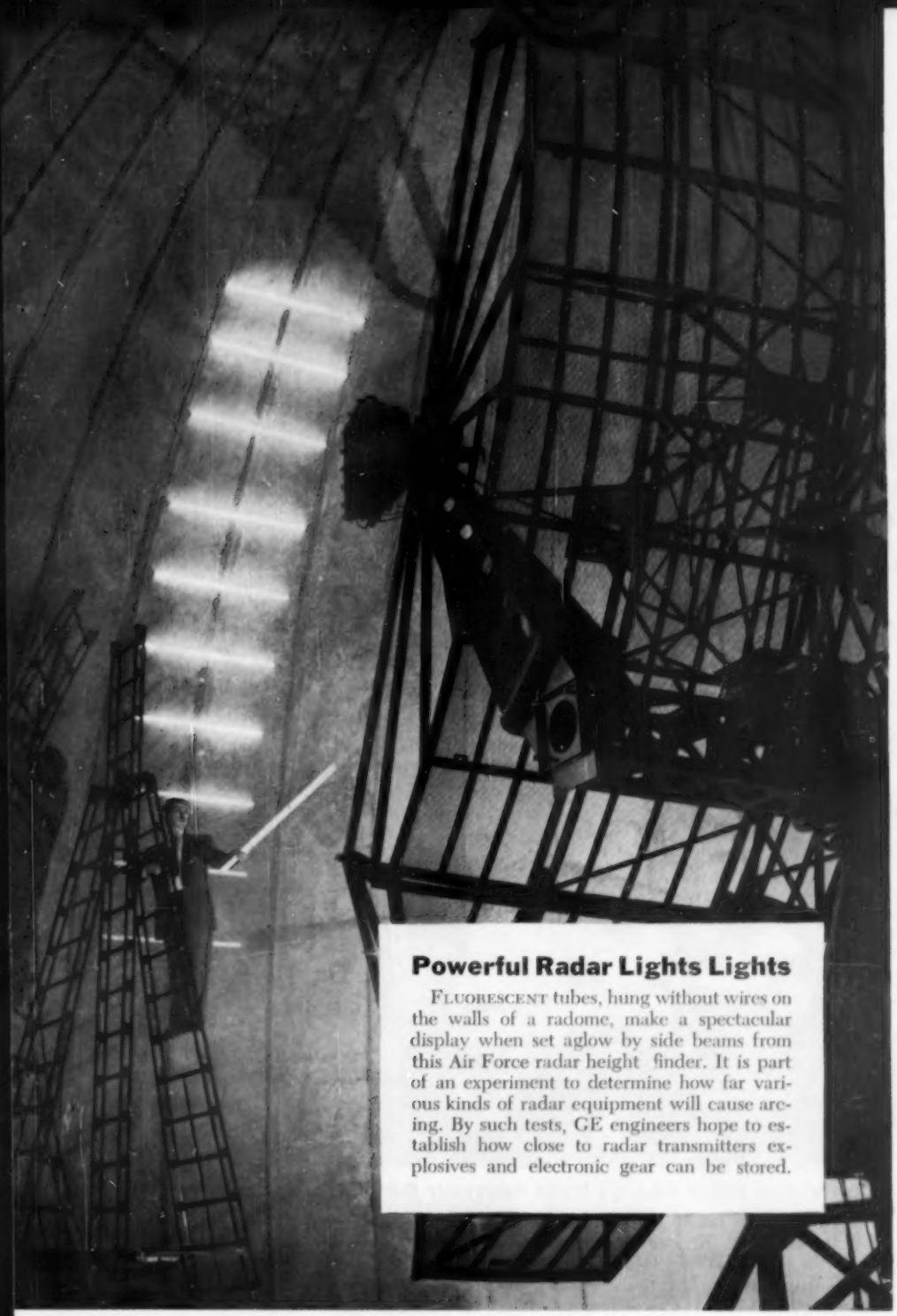
HONORS for the most beautiful large steel bridge completed last year go to this Missouri River span at Kansas City, Mo.

An American Institute of Steel Construction jury selected it both for design and for its economical use of materials.

Voice Powers Army Radio Transmitter

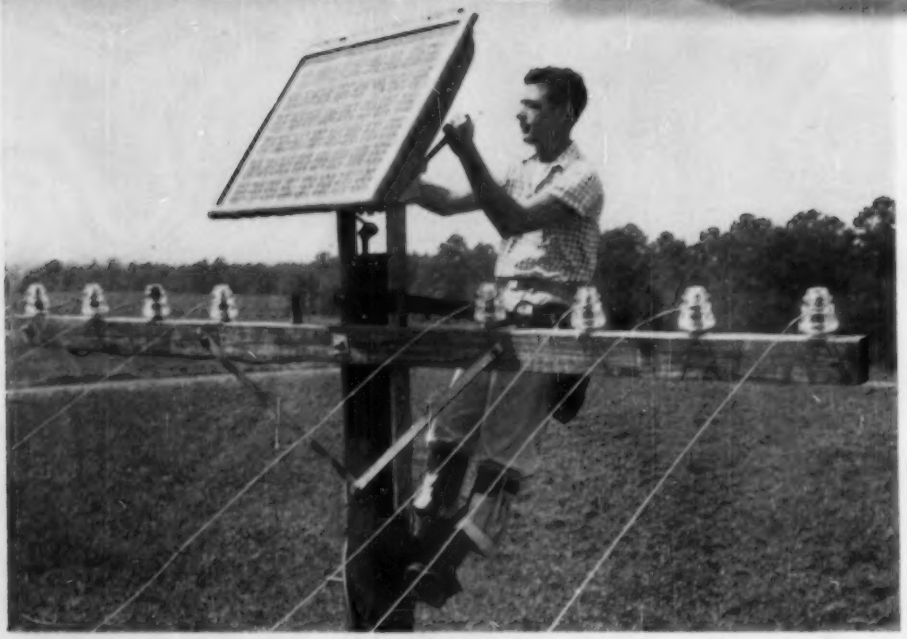
USING a single transistor and matched circuit, a new radio transmitter operates on energy generated by the sender's voice.

Inventor George Bryan, Signal Corps engineer at Fort Monmouth, N. J., is shown at left studying the oscilloscope wave pattern as he talks into a mouthpiece housing the transmitter. A companion receiver is now being developed.



Powerful Radar Lights Lights

FLUORESCENT tubes, hung without wires on the walls of a radome, make a spectacular display when set aglow by side beams from this Air Force radar height finder. It is part of an experiment to determine how far various kinds of radar equipment will cause arcing. By such tests, GE engineers hope to establish how close to radar transmitters explosives and electronic gear can be stored.



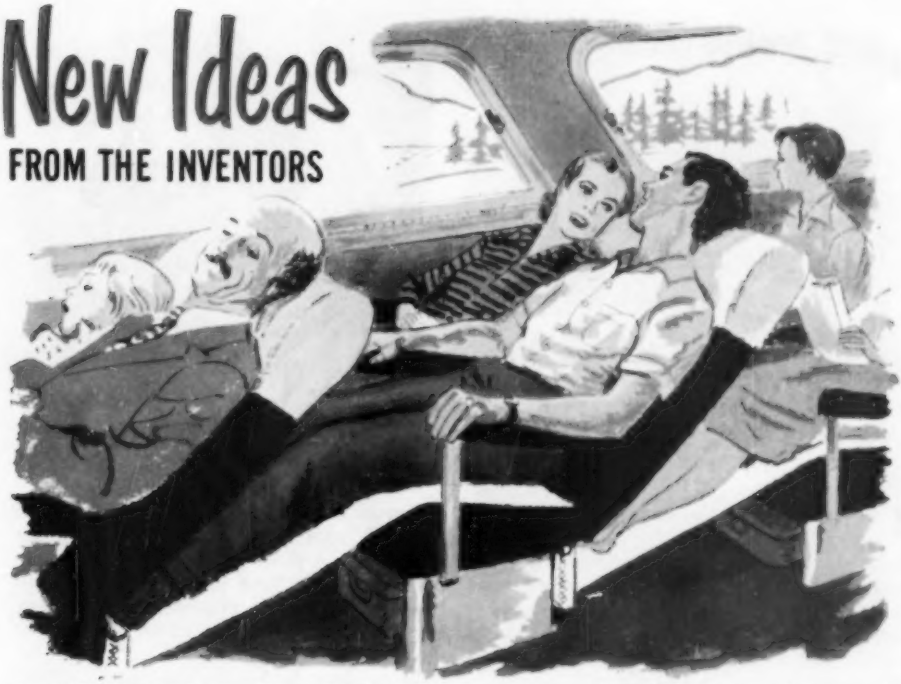
Sunlight Trapped on a Telephone Pole Powers Rural Line

SUN ENERGY captured in 432 silicon disks, each the size of a quarter, powers an experimental circuit that serves eight Bell Telephone subscribers at Americus, Ga. Light striking the positive-negative junction on the disk surfaces sets up an electrostatic charge, which is drawn by wire from the plastic-enclosed solar battery. Excess current feeds into a storage battery lower down on the pole to supply subscribers with power at night.

Converted Solar Energy Puts Amateur Radio Station on the Air

UTILIZING the sun to operate a radio set that he perfected, E. Laird Campbell contacts two stations 200 feet away. An output of .0015 watt transmitted messages on a frequency of 1,814 kilocycles during a test by the American Radio Relay League at North Granby, Conn. In the close-up on the right, six self-generating photocells, mounted on a bracket to face the sun, power the receiver (left) and the transmitter (center).

New Ideas
FROM THE INVENTORS



1 Half-Hammock to Turn Chair into Lounge. Detachable canvas strips running from seat to seat might add a touch of comfort to bus, train, or even station-wagon travel. Attached to reclining seats, they'd let a rider sit or stretch out in legs-up position. Or, by releasing snap fasteners, he could lower the tape to sit erect.

2 Spindle to Seat All Records. A retractable center for 45-r.p.m.'s would fit around the small spindle on this phonograph. Springs would lift the large center to receive 45's; weight of standard disk would lower it flush with turntable surface.

3 Dish to Reel In Soap. Soap wouldn't slide under foot or melt away so fast if it reeled into this wall holder. The cake would hook to the end of a spring-wound line; by tugging the line, you could catch or release the window-shade-type spring.

Please turn the page for more new ideas

MORE New Ideas from the Inventors

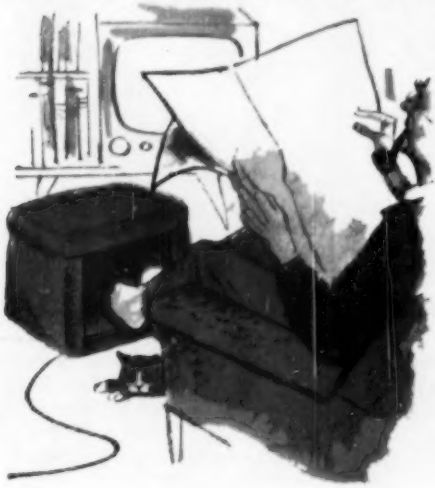
4 Fork to Clean Forks. Many dishwashing gadgets tend to skip over food particles that settle between the tines of a fork or cling to hard-to-reach surfaces between the tines and the base. The bristled clumps on this cleaning fork would dig into such missed places. The tool is designed to simplify polishing as well as cleaning.

5 Lamp to Carry Its Own Socket. You could spot your Christmas-tree lights where they'd show up best with this GE-patented outfit. Bent prongs on each lamp base would fit into a channel on a matching two-conductor wire. One twist would drive the pins through the insulation, fasten the bulb in place, and make electrical contact.

6 Tear-Off Grill to "Clean" Itself. Instead of scrubbing this cooking surface, you'd just pull a clean, new grill into position and tear off the soiled part. A roll of metal foil in a dispenser at the back of the stove would supply the renewable grill tops. The foil could be indented to form a grease receptacle. The cooking area would be surrounded by a hinged frame that would act as a guide for the foil and keep it taut. A sharp edge at the front of the frame would serve as a cutter for foil that had been used. The disposable grill could be heated by conventional gas or electric burners.

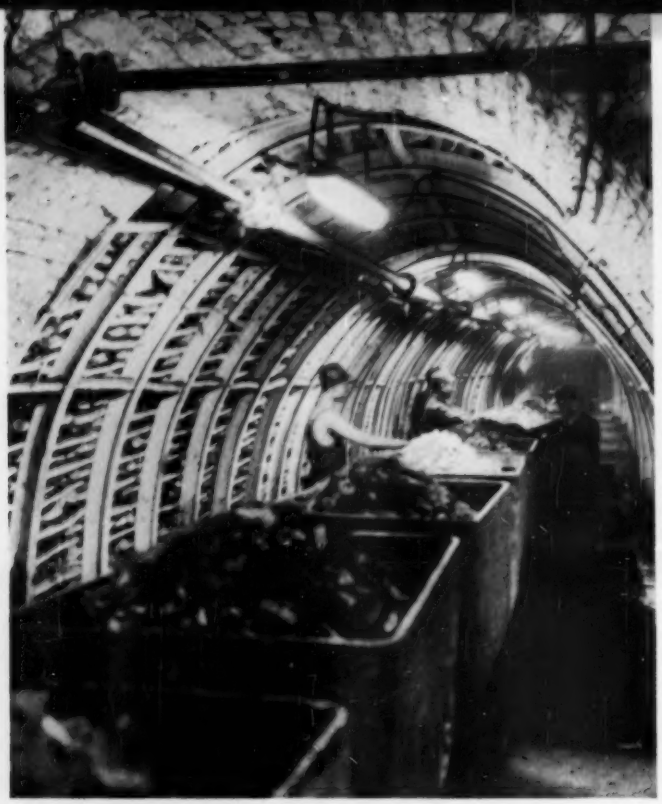
7 Heated Blade to Scrape Ice. Plugged into the cigarette-lighter socket, this electrically heated wiper would de-ice your automobile windshield by combined scraping and melting action. A heating coil just behind the replaceable metal blade would warm the scraping edge. Insulated packing would keep the handle cool.

8 Hassock to Warm Your Feet. You could rest your dogs on top of this hassock or warm them inside by pressing them against a hinged panel. Opening the door would turn on a heating unit. When you removed your feet, the door would spring shut and automatically turn off the juice.



9 Machine Gun to Fire Itself. By dropping spring-operated machine guns, planes could strafe a wide area without exposing themselves to ground fire. Landing impact would drive the mount's supporting spike into the earth and set off the firing mechanism. Paired guns, oppositely pointed, would revolve and wind downward on a threaded shaft. Reaching bottom, they'd trigger a self-destroying explosive charge.

U.S. patents on these inventions have been granted to: 1. Paul W. Erickson, Kansas City, Kan., and Mack H. Friedman, Kansas City, Mo.; 2. Norman L. Chalfin, NYC.; 3. Arthur E. Du Bois, Fort Lauderdale, Fla.; 4. Gordon E. Morton, Everett, Wash.; 5. Paul A. Carson, Pittsburgh; 6. John Hays Hammond Jr., Gloucester, Mass.; 7. James D. Clements, Richmond, Ind.; 8. Jack L. Hare, Los Angeles, and Kathryn E. Hare, Long Beach, Calif.; 9. Fay Hilliard, Houston, Tex.



Safety Fixtures Put More Light Into Coal Mines

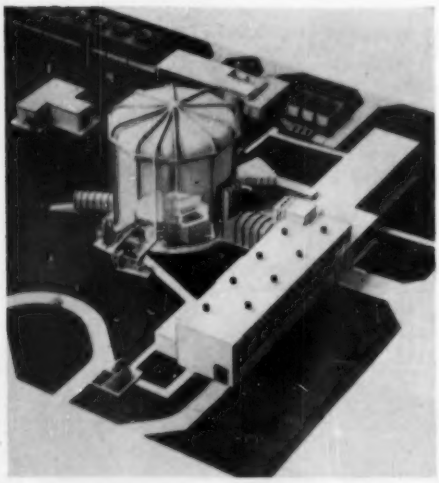
FLUORESCENT lamps, in firedamp-proof fixtures ironclad against sparking, now give Ruhr coal miners more working light.

In another type, compressed air rushing through the lamp casing clears out any explosive seepage before current enters as the tube is turned on.

And in Dutch mines, cold lamps having non-afterglow cathodes and no starters give eight times the light of incandescent systems. An explosion-proof plug-in base and adjustable sockets at both ends of the fixtures make lamp changing easy.

Farmer Strafes Mice from Air

THROUGH a furnace pipe over the side of his plane, Russell Sage bombs field mice with poison pellets. Prop blast through a venturi-tube setup forces bait, dropped at low altitude, to a crop's base. The Burt, N.Y., flying farmer seeds an acre in two minutes.



Britain Pushes Peaceful Atoms

"DIDO," a heavy-water reactor to be completed in Britain next year, is shown in the model above. With the highest neutron flux of any research reactor in Western Europe, it will help determine the pattern of Britain's future reactors for generating power.

Truck-Train Follows Leader Around Corners

ALL-WHEEL drive, plus automatic steering through mechanical couplings, guides each vehicle in this eight-truck train in the tracks of the one ahead, even on sharp turns. The operator in the forward truck steers the two front wheels by means of an electric control system.

Power for the train, built by R. G. LeTourneau, Inc., of Longview, Tex., comes from a generating plant in one car, which supplies juice to a motor in each wheel of each of the trucks in the train.

Tires, as much as 10 feet high and four feet wide, and flexibly mounted axles, enable the train to travel off the highway over sand, snow, mud and rough ground.

Three Heads Better Than One For TV Editing

THIS "three-headed monster" is used by Disney Studios to save time and costs in editing TV shows.

Negative film, taken by three cameras, is run on the right-hand reels of each mount. An editor (visible through the glass window) can blow up scenes on a master screen from any of the monitors below it. A sound track is at left on the center unit.

Science Is Popular in Toyland Now

PHOTOS BY W.W. MORRIS

WHEN more than 50,000,000 pairs of excited small hands have torn the gay wrappings off their presents, on the last Sunday morning this month, there will be more science toys in action under America's Christmas trees than ever before. The reason is that this year's new toys are, as always, a child's reflection of the adult world.

Toys have become a year-round business instead of a Christmas and birthday splurge, and sales will top the billion-dollar mark in 1955, says the Toy Guidance Council. The ones shown on these pages are among the most ingenious of the new crop. Among others are chemical sets with atomic-energy experiments, Geiger counters and a uranium-prospecting game.

1. Mobile Rocket Launcher. The plastic "birds" fired by this reproduction of a military missile launcher have a soft nose so that even a direct hit won't hurt furniture or walls. A ratchet gear raises and lowers the launcher realistically.

3. Building Blocks and Dowels. The blocks, or cubes, of Space Builder have holes into which dowels of varied lengths fit snugly. The youngsters below, using geometric patterns, have built the framework for a boy-size Indian tepee.

4. Racer with a Real Engine. A one-cylinder engine, weighing less than an ounce, powers the Automite race car. The engine has a cord-pull starter, but this lad does the job by holding one car wheel against a spinning bike wheel.

2. Remote-Control Flight Trainer. An electric motor spins the props (or helicopter rotor blades) of these aircraft. Once airborne, the plane's flight and maneuvers are manually controlled in climbs, dives, loops and landings. Props are flexible plastic.

5. Mobile Communications Center. This six-wheel tractor-trailer has a microphone and loudspeaker, a revolving searchlight that can be flashed on and off for signaling, and a buzzer system. Four batteries operate the equipment.

6. Spaceship Built for Two. Junior is waiting for his copilot before blasting off in this seven-foot, fiberboard rocket plane. The assemble-it-yourself ship has a hinged cockpit canopy and a complete make-believe "instrument" panel.

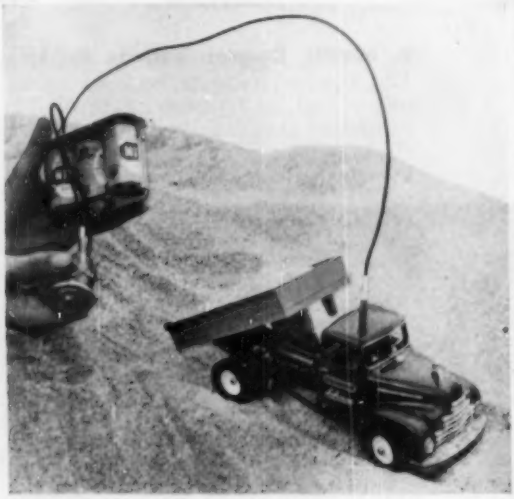
Please turn the page for more new toys

7. Outboard-Powered Speedboat. A kicker lifts this plastic Corvette Hydro hull right out of the water as it races either on a straightaway or in a circular course at the end of a control line. The 18-inch boat comes fully assembled.

8. Mechanized Sand Bucket. The two-level Aerial Sand Loader has a traveling cab with a clamshell shovel. Sand scooped up by the bucket is loaded into a movable hopper, which has a release for dumping it into the truck below.

11. Air-Navigation School. A movable map of the world is the playing surface of Astron, an air-navigation game. Cards give each player flight instructions. Landings at an airport score points; hazards, such as storms, result in penalties.

12. Remote-Control Dump Truck. One hand-held control unit puts this work truck through its paces. Turning a gear wheel steers the truck as battery power drives the vehicle in two forward speeds or reverse. Horn and headlights work.

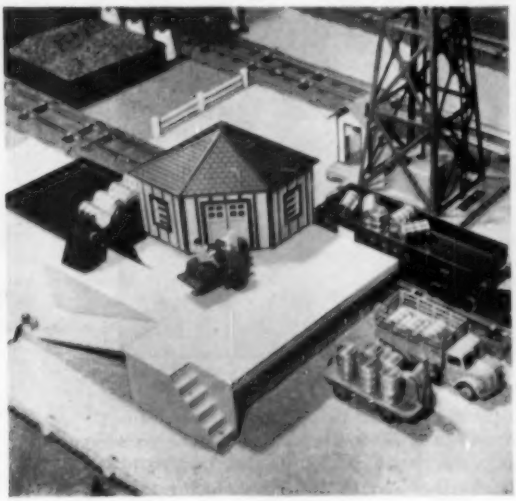


Most of these toys are generally available in toy and department stores. Following is a list of manufacturers or distributors, and approximate retail prices: 1. Ideal Toy Corp., 200 Fifth Ave., NYC ($3); 2. Marilyn Products, Inc., 8 Renee Place, Irvington, N.J. ($16); 3. Industrial Trends, Inc., 331 W. Washington Blvd., Chicago 6 ($4 to $9); 4. Wen-Mac Corp., 2240 Centinela Ave., Los Angeles 64 ($11); 5. Remco Industries, 113 N. 13 St., Newark, N.J. ($10); 6. Honor House

9. Jet-Propelled Rocket. For flights several hundred feet straight up, fill the eight-inch plastic rocket one-third full of water, pump in air (inset) and press a trigger. In flight, water ejected by compressed air makes a visible jet stream.

10. Table-Top Auto Trainer. In Driving School, a magnet moves tiny metal automobiles through streets, in and out of a garage and filling station, through a tunnel. Drivers can learn how to park, and practice safe-driving rules.

13. Electric Freight Handler. Press a button on this American Flyer accessory and Louie the Loader swings his fork-lift truck around to a ramp where he picks up an oil drum. Then he drives across the platform and dumps it.

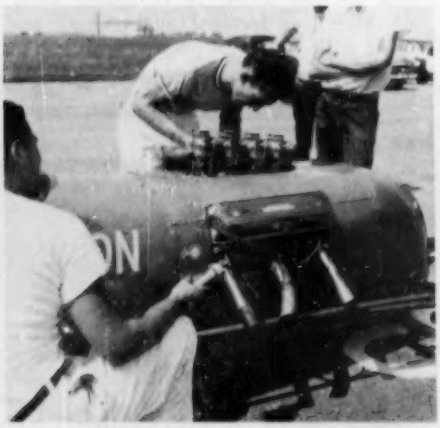


14. Robot Driver. No, he won't hurt that table leg. When the tractor touches an obstacle, Marvelous Mike's arms and legs go into action as he shifts, backs up and goes forward again along another path. Batteries operate it.

Products, Lynbrook, N.Y. ($5); 7. Wen-Mac Corp., 2240 Centinela Ave., Los Angeles 64 ($12); 8. Mound Metalcraft, Inc., Mound, Minn. ($16); 9. Park Plastics, 940 Park Ave., Linden, N.J. ($2); 10. Mattel, Inc., 5432 W. 102 St., Los Angeles 45 ($5); 11. Parker Bros., Inc., Salem, Mass. ($3.50); 12. Schuco Toy Co., 44 E. 23 St., NYC 10 ($25); 13. A.C. Gilbert Co., Erector Square, New Haven 6, Conn. ($13); 14. Saunders-Swadar Toy Co., 500 Rathbone, Aurora, Ill. ($10).

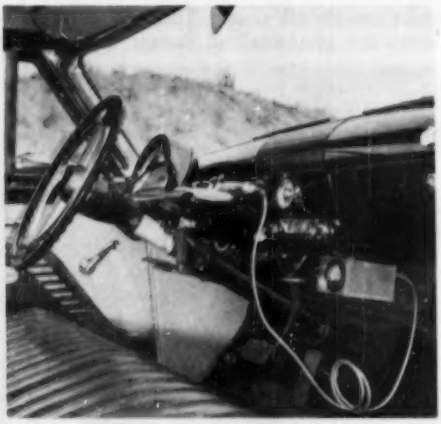
Walkie-Talkie Carhops Speed Service at Drive-in Restaurant

THE young lady in the photo (left) uses a lightweight walkie-talkie to call orders into the kitchen at Schilling's Drive-in Restaurant near Covington, Ky. The woman in the car thus gets her food faster. It's part of an electronic setup developed by Frank Lindley of Cincinnati. An operator at a receiver takes down orders from the walkie-talkie carhops. Then, when the food and check are ready, carhops are alerted by different-colored lights on signal boxes located so that they can be seen from anywhere in the parking area.



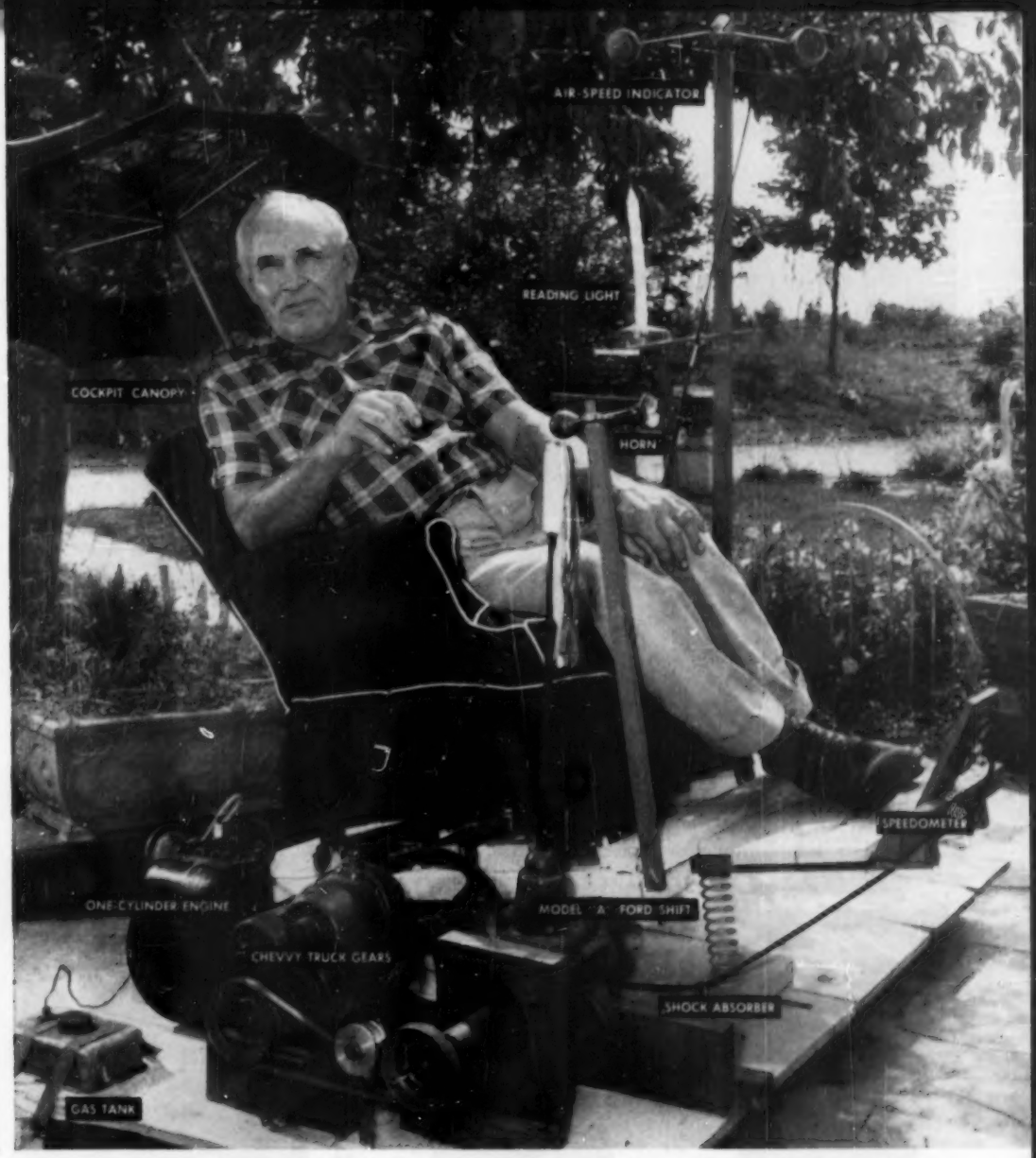
Two Engines Juice Up Dragster

WITH an Oldsmobile engine in front and a Cadillac in the rear, the "Bustle Bomb" (above) whooshed to a new drag-race record of 151 m.p.h. with driver Lloyd Scott. The Olds powers the car for the first 50 feet, then the Caddy cuts in. Reason: with 700 hp. between them, full power might cause excessive wheel spin at the start.



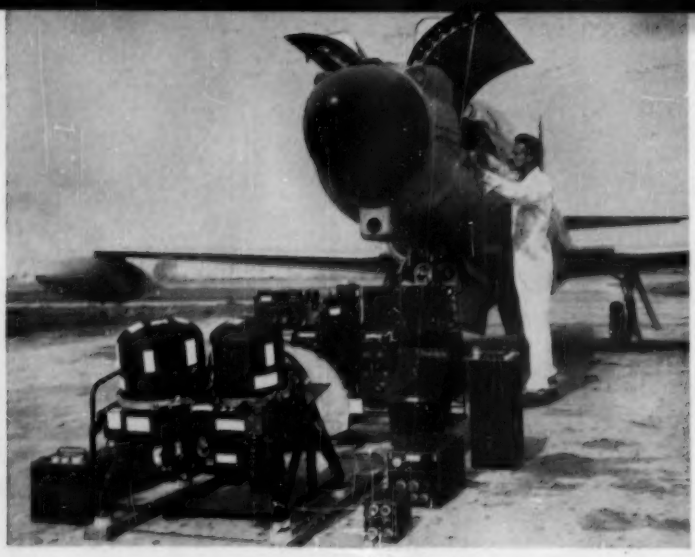
Geiger Counter Works in Car

YOU can hunt for uranium or detect radiation within a 50-foot radius while driving along in this car. Frank C. Strebe, University of California, fitted it with a detector that taps the car radio for power and sounds off with radiation clicks through its loudspeaker. The Geiger-Mueller tube and the other electronic parts used cost him about $30.



Automatic Drive Catches Up with Rockin' Chair

FELLER retired t'other day and got himself a new kind of rockin' chair. Rocks itself. Rocks him, too. Seems like when this feller, a machinist type, quit to take it easy, some other fellers he'd worked with said, "Well now! How about him havin' a chair that rocks automatic-like?" So they built it out of a one-cylinder gas engine and gears. Works, too. Noisy though. Feller's name is Frank Miller. Other fellers —them as built it—are Bill Nyman, Bob Connelly, Joe Wright and Bill Jacobus. Chair rocks itself and Frank in Huntington Station, N. Y.



FLYING BRAIN in these black boxes, occupying a total of 29 cubic feet, is about equal in complexity to 200 television sets. It includes a radar transmitter, antenna, receiver, computer, pilot's scope, and manual radar control. The photograph directly opposite shows the whole works jammed into an F94.

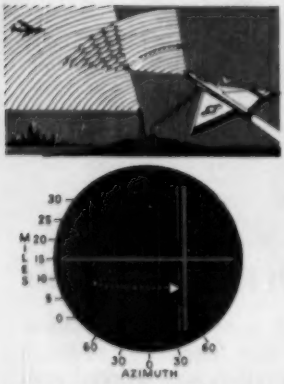
They Hit 'Em When

WHAT'S it like to attack an invisible bomber in a modern interceptor plane? The drawings below show all that the pilot needs to see. Above is the equipment that makes blind kills possible, replacing human responses with lightning-quick radar and computer reactions.

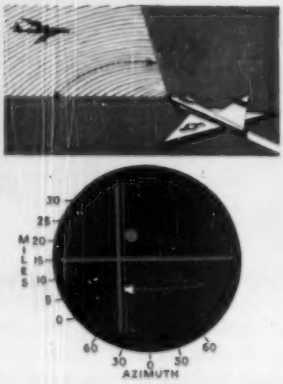
Every U.S. interceptor now carries the Hughes fire-control system, which "sees" by radar, computes course and firing data, and puts all the information that the pilot requires on a single radarscope.

Developed by the Hughes Aircraft Co., Culver City, Calif., the control system continuously shows the pilot how to fly a lead collision course despite evasion tactics. Seconds before the interceptor

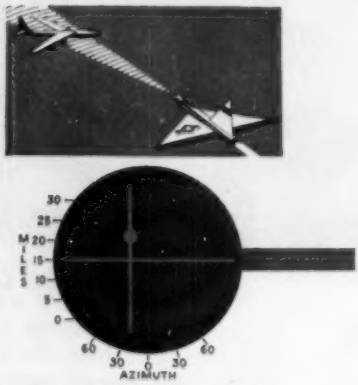
Fire-control system "sees" by radar, computes attack



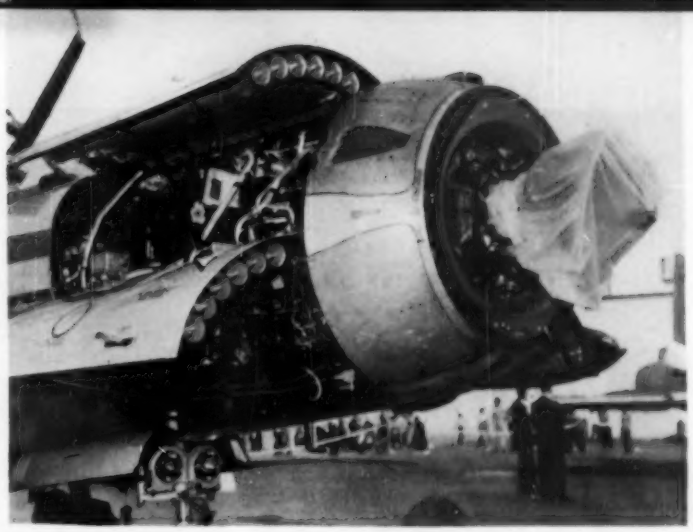
GROUND RADAR guides interceptor to target area. Pilot's scope shows a vertical line sweeping from side to side, covering radar arc of 120°. Horizontal line (artificial horizon) shows plane's attitude.



IN RADAR RANGE, sweep line on pilot's scope shows a bright blip. Scale at left gives the distance, azimuth reading the angular position of target from interceptor. Here it is 15° to port and 20 miles away.



USING HAND CONTROL, pilot can move antenna (as shown by sweep line) to spotlight bomber in his radar beam. He then presses the lock-on button. Beam follows target automatically, as image changes.



NOSE THAT KNOWS. Antenna, here wrapped up to conceal the features that are still secret, automatically sweeps from side to side over a 120° arc. This sweep shows on scope as a vertical line moving back and forth (see drawing at left below). Pilot can stop it on his target when contact is made.

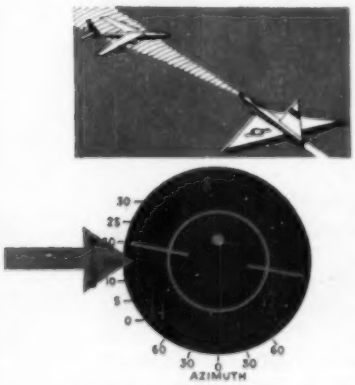
They Can't See 'Em

reaches firing position, the scope image tightens up its flight path. The computer fires the rockets at just the right instant.

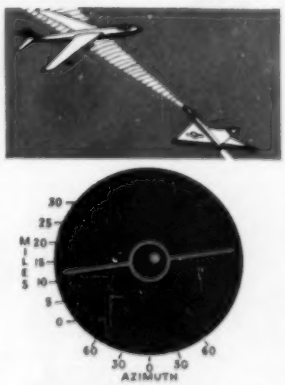
A further development, control-system tie-in, actually flies the plane from the moment the pilot locks on to his target until the attack is over.

Similar control systems will guide the firing of the Hughes Falcon (PSM, May '55, p. 127). Having a brain of its own, it can be launched much farther from its target than can rockets. At supersonic speed it can reach its target long before the launching plane could. Self-contained radar and computer equipment, so miniaturized as to be equivalent to compressing two TV sets into a football, guide it to its kill.—*Harry Walton.*

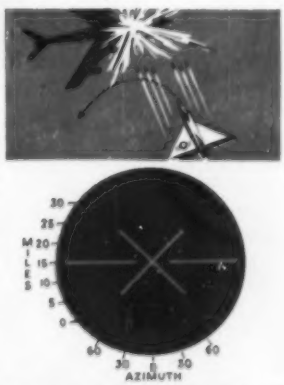
course and firing data, and puts it all on the pilot's scope.



NEW IMAGE on scope replaces sweep line with circle, target blip with steering dot. Pilot must "fly the dot"—center it in the circle. Computer plots data to bring the interceptor on a lead collision course.



WITH 20 SECONDS to go, the steering dot suddenly shrinks, forcing pilot to fly more precisely. The artificial horizon shows tilt of interceptor's wings. At 4½-second mark, the circle changes to a bar.

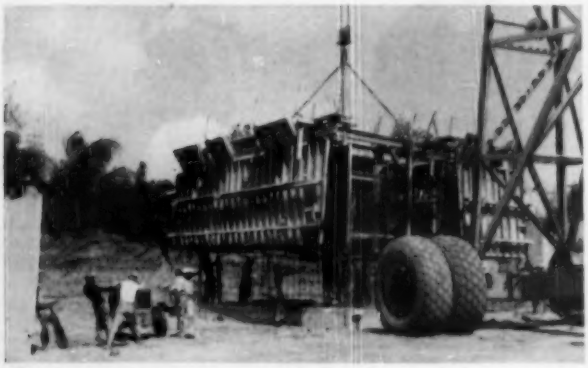


PILOT HAS SECONDS to level off for actual attack, aided by bar on scope. As rockets are launched by fire control, scope image changes to a cross to show attack is over, then returns to normal search.

Giant curved TV screens surrounding one huge hall will picture world-wide news events.

World's Largest Building to Top R.R. Station

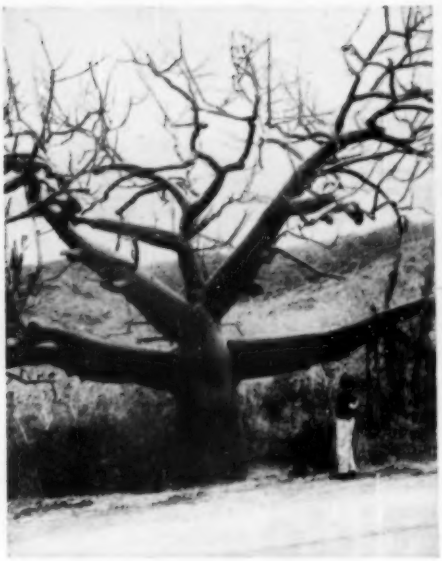
NEW YORK's proposed Palace of Progress, planned for permanent industrial exhibits, will use electronics, automation and TV to sell merchandise. Designed for use by 50,000 people, its 154,000,000 cubic feet will be nearly double the space in the Pentagon and will top the Great Pyramid's by 61,000,000. It would be built on massive girders over Penn Station without interrupting a daily flow of 689 trains.



Portable Wall Forms Speed Home Building

ONE-PIECE steel forms, moved from site to site on a huge derrick, are being used to put up six homes a day in an all-concrete, 1,625-house project in Puerto Rico.

Outer and inner walls are poured in one operation after a floor slab is laid, wiring and plumbing installed, and reinforcing rods set in. A slab roof tops the three-bedroom home.

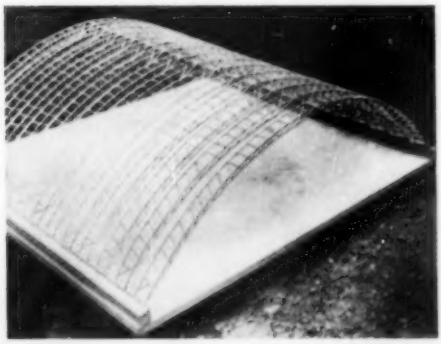


Kapok Harvesting, Anyone?

KAPOK trees like this one are going begging in the wilds of Ecuador. The Ministry of Economy has opened large tracts of land and is soliciting pioneers to develop the trees. There's little of a kapok that can't be converted—from the bark to the cottonlike hair on the fruit, which is used in clothes and as stuffing for pillows and life preservers.

Huge Tunnel Floats to Site

IT'S launching day on the Delaware for this huge section of a steel tunnel. With 22 others, it will be towed south to form a vehicular tunnel under Hampton Roads, Va. Concrete partly filling the double walls of the 300-foot casings will act as ballast on the two-day river-canal journey from Baldwin Locomotive's Philadelphia plant.



Prefab Would Seat 100,000

HERE'S a model of a $17,000,000 prefab, a huge convention hall proposed for Chicago. Plans call for a structure 1,000 feet long and 600 feet wide, with a ceiling that sweeps up to 150 feet at the top of its arch. The main floor would seat 75,000 and an air-conditioned gallery 25,000 more.

Post Office Gives Superservice

THIS motorist mails her parcels, without leaving her car, at a drive-in window in a new Palo Alto, Calif., post-office annex. In fair weather stamps can be bought, mail received or deposited through an open Dutch door. Voice ports and a slide-through drawer help when windows are closed.

WORLD'S FIRST multi-jet seaplane, hailed by the author as the shape of things to come in airliners, is this Martin SeaMaster, now being flight-tested for the Navy as a bomber.

5,000,000-mile pilot tells why

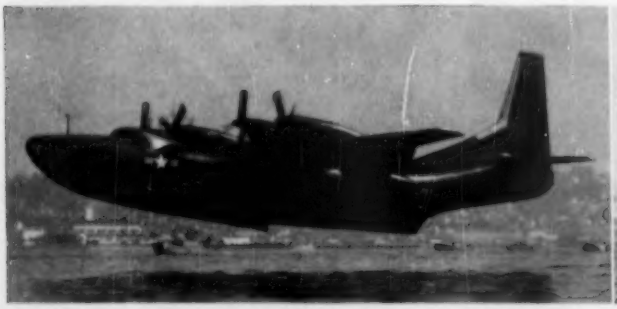
We'll Soon Ride Jet Flying Boats

By Byron Moore From his book, *The First Five Million Miles*, published by Harper & Brothers, New York

THE AUTHOR: Byron Moore, a senior pilot for American Airlines, began his flying career as a barnstormer in 1926. He also has been a Navy, Army and test pilot. Next? "As I see it," he says, "it's a race between my retirement and the advent of jet transports."

AS OUR DC-7 neared New York's Idlewild Airport on a recent flight, Air Traffic Control informed us that the weather was marginal and that we could expect a delay of 35 minutes before being cleared to land.

We'd have two hours and 15 minutes of fuel to play with. We could hang around Idlewild in the holding stack for 44 minutes, if need be; then proceed to



IN SERVICE: Convair Tradewind is the Navy's most modern flying-boat transport now. Turbine-driven propellers give this plane a speed of 350 m.p.h., compared to a pure jet's 600.

IN DISCARD: Howard Hughes' "wooden monster," as the author calls it, never got higher off the

IF REDESIGNED to carry passengers, the author says, the four-jet SeaMaster, cruising at 600 miles an hour 40,000 feet up, could cut transcontinental airline time nearly in half.

Boston, where the weather was good, and land with our 45 minutes' legal reserve of fuel.

We decided to make a try for Idlewild —and managed to squeeze in.

Had we been flying a jet that night, we couldn't have even attempted a landing at Idlewild. Along about Columbus, Ohio, we'd have changed our destination to Washington or Boston, or wherever the weather was good. Then we would either have put the disgruntled passengers on the train or on a piston-engine plane to complete their journey.

You see, jets consume enormous quantities of fuel. To get to its destination before running out of fuel, the jet relies on speed. Once the jet plane starts descent, it is committed to land.

Before the airlines can use *land-based* jets with any degree of safety and reliability, foolproof electronic landing aids will have to be developed that will permit them to land no matter what the weather.

On the other hand, had we been flying a *water-based* jet, we'd have landed at our original destination as a matter of course—and here is where I climb out on a limb to predict the future of jet airliners.

A decade ago it was thought that the flying boat—king-size version—would be the answer to ocean flying. In 1944, an $18 million order was placed by the War Department with Kaiser-Hughes Aircraft to build three huge eight-engine craft, an order that was subsequently canceled. For Howard Hughes' wooden monster was destined to failure even before it was

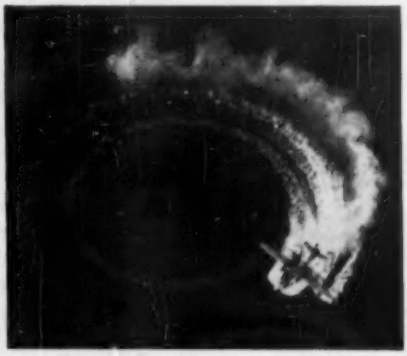
water than this. Powered by eight piston engines, it was designed to carry 700 troops.

IN DOUBT: Britain's Princess is the biggest boat actually to fly. But plans for more were suspended when even its 10 turboprops proved to be not enough for satisfactory performance.

first sketched on the drawing board.

Why? Because of the propellers. Spray can damage a propeller as seriously as sand or gravel. To keep them clear of heavy spray they had to be placed high. But if they are mounted high, their line of thrust relative to the center of resistance of the plane is offset. Attach the string to the very top of a kite and it immediately takes a nose dive. It's the same with a flying boat, whether a World War I MF Boat or a supercolossal airliner. With the propellers high—and they have to be high—the plane wants to nose-dive when the power is applied.

Not so with a jet-powered flying boat. While the air intakes must be high enough to keep green water out of them, this is nowhere near so high as is the case with propellers. A jet flying boat can be at least as efficient as its land-based counterpart. For one thing the very substantial weight of the landing-gear mechanism is eliminated.



READYMADE RUNWAYS on rivers, harbors or lakes near most big cities are claimed by flying-boat enthusiasts as an advantage for seaplanes over land-based transports.

Another factor is the airport problem. The present trend toward longer runways, the tendency of housing developments to surround present airports, creating a noise problem as well as a hazard, is shoving airports ever farther from the cities. In some cases the time consumed bucking traffic to and from the airports exceeds the time in the air. This situation will continue to worsen.

Blind landing would be no problem for the jet flying boat. Blind landings could be accomplished in land-based planes if runways of sufficient length and breadth were available—five miles long and a half-mile wide, for instance; obviously impractical and economically out of the question, of course.

But on each of our coasts we have unlimited sea room.

Many of us old flying-boat pilots have made hundreds of completely blind landings. No special skill is required. You simply hold the airplane in landing position, with reduced power, and wait. Any boat pilot will tell you that these landings are invariably smoother than when they can *see* the water.

The pilot flying the jet flying boat of the future, when approaching his destination, will be assigned a specific "sea lane," which will be outlined by lighted buoys and have its own landing-aid radio frequency. In good weather he'll probably land in the East River, five minutes in a taxi from the New York hotel area.

Great strides have recently been made in the hydrodynamics of flying-boat hulls. Then there is the hydro-ski, or water ski: shock-mounted, it absorbs the initial impacts of rough water landings, relieving hull and wings from impact stresses. In flight the ski is simply retracted into the plane's structure. Convair's Sea Dart, a water-based supersonic fighter, takes off and lands on hydro-skis.

Glenn L. Martin has just this year brought out a four-jet flying boat for the Navy. Its reported speed is 600 miles per hour or better. With its cruising altitude of 40,000 feet, it would cut transcontinental flying time nearly in half. A passenger version of this plane would save an additional 30 minutes' ground travel at the eastern terminal by landing close to Manhattan.

Rarely would such a craft have to cancel a trip or be diverted because of thick weather. Foggy terminal weather could delay its docking, perhaps, but this would certainly be a minor inconvenience compared to winding up in Boston or Washington. END

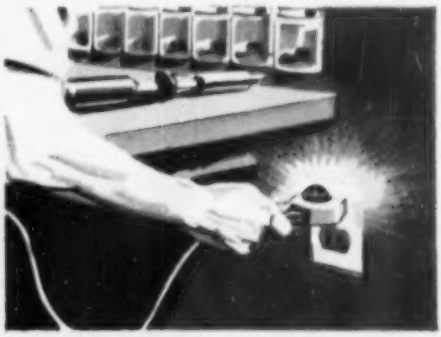
I'd Like to see them make...

A PLAYPEN WITH A GATE at one side, so that a mother could release a heavy baby without straining her back to lift him over the rail.—*Mrs. F. S. Elander, Puente, Calif.*

A SHOWER-BATH FOOTREST that could be mounted in a bathtub or shower stall, to eliminate balancing on one foot while scrubbing the other.—*L. Robert Oaks, Plainfield, N. J.*

A PULL-OUT WASTEBASKET under the front seat of an automobile. This is waste space anyway unless there is an under-the-seat heater.—*Earl Rasmusson, Grants Pass, Ore.*

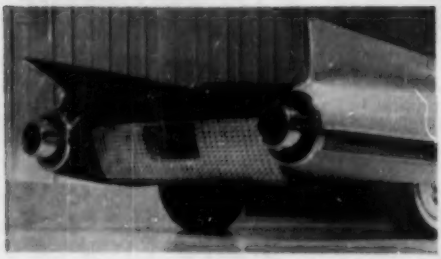
A BEDCLOTHES CLIP at the foot of a Hollywood bed that would snap shut on the sheets and blankets. The bedspread would conceal it. —*Mrs. L. C. Short, Seattle, Wash.*



A RED PILOT LIGHT to plug between cord and socket so that you wouldn't go off and leave a kitchen appliance or a shop tool plugged in overnight.—*Bob Bruce, Edinboro, Pa.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

Ford Designs A Body for a Gas Turbine



A FUTURISTIC concept of a passenger car that would be powered by a gas-turbine engine has been put on display by the Ford Motor Co. Called the Mystère, it is a sort of exercise in imaginative styling. The car contains innovations that could well find their way into future designing.

A huge bubble of glass serves as roof, windows and windshield. This canopy, hinged at the back, can be pushed up 70 degrees. Passengers get in and out through half-doors. The front seats swivel outward to make it easier.

A scoop at the top of the windshield supplies air to the passengers. Buttons on an overhead rib control the air, a heater and a blower.

Big air inlets are indented on the rear fenders to supply the engine. Twin exhaust pipes are cannon-muzzle size.

Each headlight has two bulbs, one for city driving, one for the highway.

A push-button ignition switch works like the combination lock on a safe.

The panel of instruments is somewhat like that on a jet fighter. The faces are domed, can be read from any position.

The car has no engine, but provision has been made for one under the rear deck. Luggage and a spare tire would be carried under the hood.

Body for the turbocar is only 52 inches high,

RADIOTELEPHONE reposes behind a console between the two rear seats—of the bucket type, like those in front. Because the car is completely closed in, it would be air-conditioned.

220 inches long and 80 inches wide. It could tote four people—how fast, nobody knows.

INSTRUMENT PANEL, reading left to right, shows: engine bearing temperature, oil supply, compressor r.p.m., fuel, speed, direction, pitch and roll, the time of day and the altitude.

AIRPLANE-TYPE WHEEL "throws over" so that car can be driven from either front seat. A safety crash pad extends clear across the panel. Yup, that's a television set behind the front seat.

Navy's First Midget Sub Is Built to Fight in Close Quarters

CAPABLE of turning practically on a dime, a 50-foot submarine—first of a new Navy class—has been assigned the duty of testing our harbor defenses. Intended for close-in attacks on enemy harbors and shipping, it is steered like an airplane. Designed by the Fairchild Corp., it can be built in inland plants and transported to water.

Shelter Filters Atomic Dust

A CHEAP, chemically treated fiberboard has been developed for military and civilian atomic-bomb shelters. Called "diffusion board," it filters out poison gas, disease-laden particles and radioactive fall-out while admitting oxygen. Carbon dioxide given off in breathing passes through to the outside.

Dr. Alfred J. Stamm of the U.S. Forest Products Research Laboratory, who is shown at left with a small test model, has conducted pilot manufacturing runs at two plants with various species of wood pulp as a base. Equipment was much the same as that used in making ordinary building board.

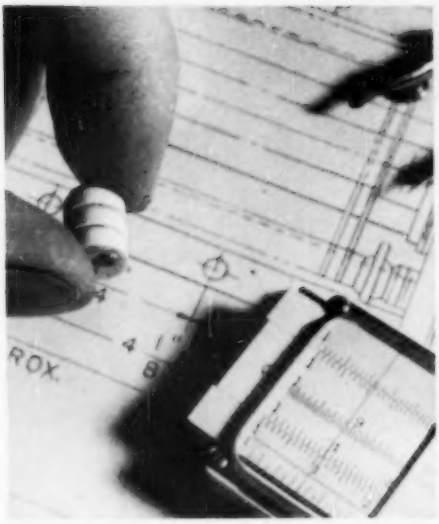
They Say Now .....

JOHN S. WINTRINGHAM, ETHYL CORP. RESEARCH LABORATORIES: *"During its lifetime, the average automobile consumes fuel having a total cost greater than that of the vehicle itself."*

J. J. PARKES, PRESIDENT OF THE SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS: *"The influence of the guided missile in various forms is beginning to make itself felt . . . If the atmosphere of international tension is now somewhat relieved, then the aircraft industries of the free world may claim some share of the credit."*

ALLISON C. NEFF, PRESIDENT OF THE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS: *"The future course of American industrial achievement and national defense will be largely dependent on the engineering skills which can be developed from the generation now in high school."*

DR. BOSTWICK G. KETCHUM, WOODS HOLE OCEANOGRAPHIC INSTITUTE: *"If we were all to disappear from the face of the earth tomorrow, most of life would go on unchanged. However, if . . . photosynthesis by green plants were to stop tomorrow, man would continue to live only as long as the stock on the grocer's shelf lasted."*



TV triode, low in noise and high in gain, may bring televison to areas now blacked out. A ⅜-inch-high stack of layers of ceramic and titanium, the tube tops 'em all for amplifying UHF signals, says GE. Its resistance to shock and vibration fit it for use in aircraft and heavy guns; its heat resistance, for jets and guided missiles.

Electronic eyes, hardly bigger than a needle's eye, pack power to activate sorters for business machines or safety devices on heavy machinery. Because they're so tiny, they can pinpoint intricate light patterns, says the Electronics Corp. of America. In military use the photosensitive cells could determine the pattern of moving targets.

Tiny Things Make Big Things Go

Wafer battery cells, packed 13 high in a two-inch plastic tube and insulated by thin Pliofilm, deliver a 22½-volt wallop. A third more powerful than conventional flat cells, they are made by the Burgess Battery Co., Freeport, Ill., for use in pocket radios, Geiger counters, photoflash cameras and other small electronic devices.

Wrist-watch power pack is smaller than a penny yet delivers almost constant voltage for two years. It won't leak, swell or emit gas. Developed by Elgin, it is made of indium, a metallic element new to batteries, and secret cathode materials. Some expected uses: powering hearing aids, recording devices and self-focusing cameras.

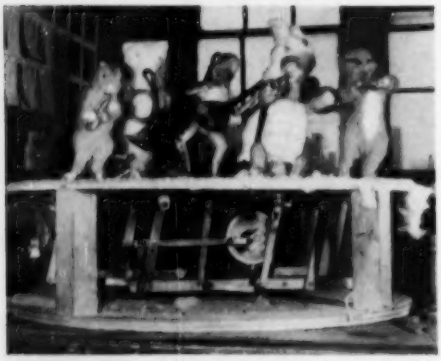
America's Favorite Christmas Windows

These mechanized displays, which you'll see in the big stores this holiday season, were engineered to stop sidewalk traffic.

By Gardner Soule

"THIS one will be," says George Grant Silvestri, "the movingest Christmas yet." He should know, because he dreams up and manufactures the elaborate Christmas windows that so many U.S. department stores display.

Mechanism under counter jigs soda drinkers.



Motors, cams, levers animate dance band.

Some 150 other display manufacturers do likewise; but Silvestri's yearly gross—nearly two million dollars—makes him, he says, the biggest.

Merchants throughout the nation buy his windows for exactly one purpose: to stop you and lure you inside.

"That means motion," says Silvestri. "Lots of moving figures. I've never seen people seven, eight or 10 deep before a still window."

Silvestri has, accordingly, spent the last 12 months getting into his 1955 windows every moving object that he can think of, to keep you from walking past. His hopes are based on solid past performance. One New York City store has to erect barricades in front of its Silvestri windows annually, and needs both private guards and city policemen to manage the crowds.

Some of his windows contain only one moving figure (like an angel playing a harp) and cost only about $950. Other windows have as many as a dozen dolls (the trade name for them) in motion: Santa Clauses, animals, reptiles, fish, birds, angels, shepherds, Wise Men, fairy-tale and storybook people.

The most carefully kept secret in Silvestri's trade is what the year's windows will show. For this Christmas, Silvestri sprang on his competition, as the cream of his displays, the three "spectaculars" shown in color on the next three pages:

Animals in the woods. This is a whole series of window displays, each holding dozens of animals that do dozens of things. The displays sell for $5,975 each, and a store can buy any number, or even a part of one.

[*Continued on page 238*]

Country Store

IN AN ELABORATE '55 STORE WINDOW, in the photo at top, the postmistress throws up her hands at packages. Other figures warm themselves at the stove. At the fountain, in the bottom picture, soda (colored with Easter-egg dye) overflows as soda jerk flirts. Boy and girl at left alternately bend over soda, straighten up.

Animals in the Woods

WOODLAND FOLK below watch swimming fish, one of a series of animal displays. In the feast at right, a bunny tosses salad, a raccoon, rabbit and squirrel eat sundaes, birds peck crumbs, a raccoon cuts cake, a baby skunk drinks milk.

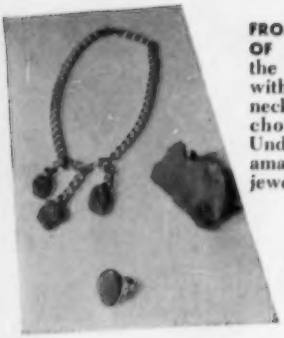
The Christmas Story

STAINED-GLASS FIGURES above resemble church windows. In the Nativity scene at right, the Three Wise Men and shepherds follow the Star of Bethlehem across the window, and then turn to behold Mary, Joseph and the Holy Child.

Cutting semi-precious stones

JEWELS IN THE ROUGH, these slabs of rocks and minerals are, reading clockwise from top center: chrysocolla (Arizona), lapis lazuli (Chile), rhodonite (Patagonia), malachite (Belgian Congo), thomsonite (Mexico), vesuvianite (California), rhodochrosite (Patagonia) and grossularite (Oregon). At the center is variscite, from Utah.

BAROQUES (below) are small pieces of rocks and minerals that have been tumbled around in a steel drum with first an abrasive, then a polishing agent for 16 to 20 days.



FROM A FRAGMENT OF TURQUOISE like the one displayed with them came the necklace and cabochon ring at left. Underwood teaches amateurs to create jewelry like this.

A RARE DISCOVERY, these fragments of vesuvianite (green areas) in a chloride schist were brought in by two rock hunters who found them in a California canyon.

A SINGLE BAROQUE of ruby-colored slag cemented to a mount at one end of a heavy, ornamental chain (below) makes a striking belt for a lady. The process took only a few minutes.

started as a hobby. Now . . .

Do-It-Yourself Jewelry Is a Booming Business

By Wesley S. Griswold

IF IT would improve your standing in the family to be able to deck your wife with jewels, you might well consider taking up a new hobby—that of cutting, polishing and setting semi-precious stones.

Jewels aren't the only end-product. Amateur lapidaries (that's the formal name for devotees of this indoor sport) also make tables, lamps, mosaics, sculptures and bookends out of pretty rocks.

Out West, where the raw material is closer at hand than elsewhere and more varied, there are at least 75,000 lapidaries in the San Francisco Bay area alone. Throughout the nation, there are estimated to be 2,000,000.

Hobbyists range in age from six to 90. Two of the more unusual ones are Lloyd and Florence Underwood, of Belmont, Calif. These two are in the enviable situation of having parlayed their hobby into a thriving business. They sell the raw materials, create a wide range of products and market them, and teach others how to do likewise.

A handful of agates lured Lloyd, a former heating contractor, into working with rock. He fell under the spell of colorful stones while on a vacation eight years ago. Now his wife, too, is so entranced that she was overjoyed recently when a 93-pound chunk of dirty rock was dumped on her kitchen floor. The rock was California vesuvianite. It didn't look like much to a visitor, though it had interesting waxy-green streaks in its gray bulk. But Florence Underwood gazed at it with delight. She said that it was extremely rare in both quality and size, and those green streaks could be cut up into lovely rings, pins and earrings.

STARTING FROM SCRATCH, Lloyd Underwood begins sawing up a chunk of semi-precious stone, as it occurs in nature, into quarter-inch slabs to be ground and polished into gem stones.

Mrs. Underwood is a composer with 17 major musical works to her credit. In 1953, the San Diego Symphony Orchestra played her tone poem, "A Hopi Indian Legend." It was a gratifying success, the pinnacle of her career. Determined to avoid a letdown, she immediately began searching for a fresh challenge.

A business in five figures resulted. Down by the tracks in Belmont she found a vacant shop. Only after it was rented did she let Lloyd in on her scheme—to set up a place where people like her husband could come to buy stones or learn about them, get acquainted with the tools needed to make objects out of them, and be taught how to use the tools.

She engaged Lloyd to instruct evening classes in lapidary work, and a retired

[Continued on page 244]

7,800 Christmas Lights Illuminate a Pennsylvania Farm

FIVE miles of lights glow to tell the world it's Christmas on the farm of William M. Koziar near Reading, Pa. He has strung 7,800 colored bulbs on 28,750 feet of wire over his house, barn, sheds and chicken house, and around fences, trees, shrubs and a sizable pond. Four 230-volt circuits feed the outdoor display as well as indoor Christmas scenes, and power loudspeakers amplifying recorded holiday music for added atmosphere.

Ground Nozzles Douse Fire

A SUDDEN ground fire in Boeing's aircraft fueling area at Seattle would be doused by a system of turret nozzles that eject a three-inch blanket of flame-smothering foam in less than a minute (above). Thermostats or push buttons in ground stations set off this spray and also water-fog nozzles to curtain off the flames and keep them from spreading.

Dollies Move 200-Ton Hangar

AIR traffic is stopped while this 200-ton airplane hangar is moved a mile to a new site by Mobilized House Movers, Inc., Austin, Tex. The half-acre shelter was jacked up on 14 four-wheel dollies and pulled by two trucks. It will be the nucleus for a 900-foot-long Southwest Airmotive service and passenger terminal at Love Field, Dallas.

The New TVs Are Bigger, More Powerful

Lots of changes inside the cabinets give '56 sets brighter and sharper pictures—even in the fringe areas.

By Hubert Luckett and Martin Mann

THE 1956 television receivers are like the 1956 cars. They are bigger, more powerful, and considerably easier to operate.

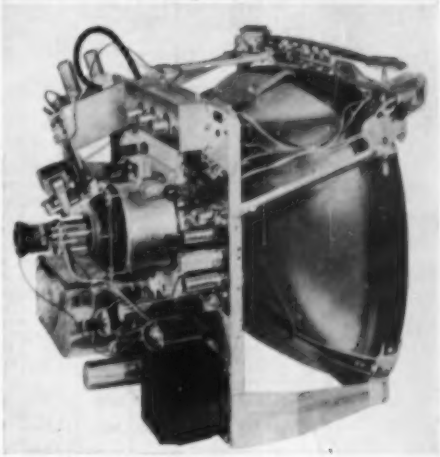
On the following two pages you will see a chart comparing 22 makes of new sets. The listing is by chassis. The same chassis is often used for many models.

The difference between models is generally in the picture-tube size, the cabinet and the loudspeaker. Sometimes, however, a maker will soup up a low-priced chassis for higher-priced models, leaving it basically the same but adding better picture tubes and tuners.

Picture tubes. Twenty-one-inch tubes are the most popular size now. Some of them give bigger pictures than others, but the difference is not as great as you may be led to believe.

The variation seldom exceeds five or 10 square inches—two to four percent of the total picture area.

[*Text continued on page 122*]



WHY THE CONTROLS ARE ON TOP. They are convenient there, but they also naturally come out that way when the chassis is arranged vertically, as it is in many of the new sets (lower photo at right). A conventional horizontal chassis is shown in the upper picture. Vertical chassis is more compact, lighter in weight, and somewhat easier to service.

For a box score of '56 TV sets, please turn the page

1956 TV SETS

	CHASSIS DESIGNATION	PICTURE TUBE			LOCATION OF CONTROLS									PICTURE DETAIL	
		Face	Focus	High Voltage	Tuning & Volume	Brightness	Contrast	Vertical Hold	Horizontal Hold	Height	Width	Vertical Linearity	Horizontal Linearity	No. IF Stages	IF Band Width (megacycles)
ADMIRAL	17"-21"-24" Advance Cascode	alum.	auto.	18,000	front	side	side	side	rear	rear	none	rear	none	3	3.5
	21"-24"-27" Super Cascode	alum.	auto.	18,000	front	front	front	front	rear	rear	none	none	rear	3	3.5
CAPEHART	21"-24" CX-43	alum.	auto.[b]	15,000	side	side	side	side	side	inside	none	inside	none	3	3.25
	21"-27" CX-38S	alum.	auto.[b]	18,000	front	front	front	front	front	rear	rear	rear	none	3	3.25
CBS-COLUMBIA	21" 1611	alum.	auto.[b]	15,000	front	rear	front	front	front	rear	none	rear	none	3	3.35
	24" 1621	alum.	auto.	18,500	front	rear	front	front	front	rear	rear	rear	none	3	3.35
CROSLEY	17"-21" Advance	alum.	auto.	13,000	side	rear	side	side	side	inside	none	inside	none	3	3.5
	21" Custom V	alum.	auto.	14,500	side	side	side	side	side	side	none	side	none	3	3.5
	21" Eldorado	alum.	magn.	16,500	front	front	front	front	front	front	rear	front	rear	4	3.5
DuMONT	21" 352	gray	auto.	14,500	front	front	front	front	front	rear	rear	rear	none	3	3.50
	21" 350	alum.	auto.	14,500	front	front	front	front	front	rear	rear	rear	none	3	3.50
	21"-24" 340	alum.	auto.	17,500	front	front	front	front	front	rear	rear	rear	none	3	3.75
FLEETWOOD	21" 610B	sold separately			front	front	front	front	front	front	n.a.	front	n.a.	4	4.0
	21"-24"-27" 810	sold separately			front	front	front	front	front	front	n.a.	front	n.a.	4	4.0
	21"-24"-27" 800	sold separately			remote	remote	remote	front	front	front	n.a.	front	n.a.	4	4.0
GENERAL ELECTRIC	17"-21" Pacer "N"	gray	auto.[b]	n.a.	front	front	front	front	rear	rear	rear	rear	none	3	3.25
	21"-24" Pacer "S"	alum.	auto.[b]	17,000	front	front	front	front	rear	rear	rear	rear	none	3	3.25
	21" Ultravision	alum.	auto.[b]	17,000	front	front	front	front	rear	rear	rear	rear	rear	3	3.25
HALLICRAFTERS	21" A-1900	alum.	auto.	12,600	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3	n.a.
	21"-24" A-1850	alum.	auto.	12,600	side	rear	side	side	side	inside	inside	inside	none	3	3.25
	21" A-2000	alum.	auto.	12,600	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3	n.a.
HOFFMAN	17"-21"-24" Mark X	alum.	magn.	n.a.	front	front	front	front	rear	rear	rear	rear	none	3	3.5
	21"-24" Super Mark X	alum.	magn.	n.a.	front	front	front	front	rear	rear	rear	rear	none	3	3.5
	21"-24" Mark V	alum.	magn.	17,500	front	front	front	front	rear	rear	rear	rear	none	4	3.75
MAGNAVOX	17"-21"-24" 600	alum.	auto.[b]	16,000	top	top	top	top	top	rear	rear	rear	rear	3	3.2
	21"-24" 650	alum.	auto.[b]	15,000	top	top	top	top	top	rear	rear	rear	rear	3	3.2
	21"-24" 350	alum.	auto.	15,000	front	front	front	front	front	rear	rear	rear	rear	3	3.2
	27" 500	alum.	auto.	20,000	front	front	front	front	front	rear	rear	rear	rear	4	4.0
MIDWEST	21" C22	gray	auto.	14,000	side	side	side	side	rear	rear	none	rear	none	3	3.1
	21" TC26	alum.	auto.	17,000	front	front	front	front	front	rear	none	rear	none	4	3.1
MONTGOMERY WARD	17"-21" GSL	alum.	auto.	12,500	front	rear	front	rear	rear	rear	none	inside	none	3	2.85
	21" GSE	alum.	auto.[b]	13,500	front	front	front	front	front	rear	none	rear	none	3	3.0
	21" WG	alum.	auto.	16,000	front	front	front	front	front	rear	none	rear	none	3	3.35
	21" Supreme	alum.	auto.	16,000	front	front	front	front	front	rear	rear	rear	none	3	3.35
MOTOROLA	21" TS530	gray	auto.	17,000	front	front	front	front	front	rear	rear	rear	none	3	3.7
	21"-24" TS534	alum.	auto.	18,000	front	front	front	front	front	rear	rear	rear	none	3	3.7
	21"-24" TS533	alum.	auto.	18,000	front	front	front	front	front	rear	rear	rear	none	3	3.7
PACKARD-BELL	17"-21" V8-1	alum.	auto.[b]	16,000	side	side	side	side	rear	inside	none	inside	none	3	3.0
	21"-24" 8851	alum.	auto.[b]	15,000	front	front	front	front	front	front	none	front	none	3	3.0
	21"-24" 98D1	alum.	auto.[b]	15,000	front	front	front	front	front	front	none	front	none	3	3.0
PHILCO	17"-21" 330	gray	magn.	14,250	front	front	front	front	front	rear	rear	rear	none	3	3.25
	21"-24" 390	alum.	magn.	14,750	front	front	front	front	front	rear	rear	rear	none	3	3.25
	21"-24" 440	alum.	magn.	15,000	top	top	top	top	top	rear	rear	rear	none	3	3.25
RAYTHEON	21" 21T193C Starmonic	alum.	auto.	n.a.	top	top	top	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3	2.9
	21" 21T40 Aristocrat	alum.	auto.	n.a.	front	front	front	front	front	front	inside	front	none	3	3.1
RCA	17"-21" Special	alum.	auto.	15,000	top	top	top	top	top	inside	inside	inside	none	3	3.2
	21"-24" Super	alum.	magn.	17,000	top	top	top	top	top	inside	inside	inside	none	3	3.2
	21"-24" Deluxe	alum.	magn.	17,000	side	front	side	front	front	rear	rear	rear	none	3	3.2
SEARS, ROEBUCK	17"-21"-24" "Fringe Area"	alum.	auto.[b]	14,000	side	rear	side	side	side	rear	none	rear	n.a.	3	3.0
	21"-24" Super Power	alum.	auto.[b]	18,000	front	rear	front	front	front	rear	none	rear	n.a.	3	3.0
SYLVANIA	21"-24" 32	alum.	auto.	18,000	front	front	front	front	front	rear	rear	rear	rear	3	3.3
	21"-24" 33	alum.	auto.	18,000	front	front	front	rear	rear	rear	rear	rear	rear	4	3.8
TECH-MASTER	21"-27" 5618	sold separately			front	rear	front	rear	front	rear	rear	rear	rear	3	3.5
	21"-24"-27"-30" 2430-S	sold separately			front	front	front	front	front	rear	rear	rear	rear	4	3.9
	24"-27"-30" 630-5	sold separately			front	front	front	front	front	rear	rear	rear	rear	4	3.9
WESTINGHOUSE	17"-21"-24" Catalina	alum.	auto.	18,250	top	top	top	top	top	rear	none	rear	none	3	4.0
ZENITH	21"-24" 17X	gray	auto.	14,000	front	top	top	top	top	top	inside	top	none	3	n.s.
	21"-24" 19X	alum.	auto.[b]	16,500	front	front	front	front	front	front	inside	front	none	3	n.s.
	21"-24"-27" 22X	alum.	magn.	20,000	front	front	front	front	front	front	front	front	none	3	n.s.

Specifications and price are for cheapest 21" VHF model using chassis indicated. Speaker data covers all models.
[a]Picture tube, damper, high voltage and power rectifiers are not included; [b]adjustable for best focus by service.

PICTURE STABILITY						PICTURE POWER				SPEAKERS AVAILABLE	POWER SUPPLY	PRICE
Automatic Gain Control		Noise Killer	Interference Filters	Antenna Pad	Intermediate Frequency	No. Tube Functions[a]	Sensitivity (microvolts)	Front End Type	No. Video Amp. Stages			
Type	Adjustment											
derived	local-dist.	no	FM trap	no	20	n.a	50	cascode	1	one: 4"	transformer	$170
keyed	variable	yes	FM trap	no	20	n.a.	50	cascode	1	one: 4", 10" or 6" x 9"; two: 6" x 9"	transformer	$190
derived	none	no	n.a.	no	40	19	n.s.	cascode	1	n.a.	transformerless	$170
keyed	none	yes	high pass	no	40	23	n.s.	cascode	1	one: 4" x 6"; three: 3", 3" and 8"	transformer	$200
derived	local-dist.	no	high pass	no	40	19	n.s.	cascode	1	one: 5", 6", 8" or 6" x 9"; two: 5", 6" or 6" x 9"	transformerless	$170
derived	local-dist.	no	high pass	no	40	20	n.s.	cascode	1	one: 8"	transformerless	$290(24")
derived	none	no	band pass	n.a.	20	18	60	pentode	1	one: 4" or 5"	transformerless	$170
keyed	variable	yes	band pass	n.a.	40	21	35	cascode	1	one: 5¼" or 8" x 12"	transformerless	$200
keyed	variable	yes	band pass	n.a.	40	n.a.	15	cascode	2	two: 4" and 8" x 12"	transformer	n.a.
derived	variable	no	high pass & IF trap	no	40	23	n.s.	cascode	1	one: 4"	transformer	$190
derived	variable	no	high pass & IF trap	no	40	23	n.s.	cascode	1	one: 6", 8" or 10"; two: 6"	transformer	$210
keyed	variable	yes	high pass & IF trap	no	40	28	n.s.	cascode	2	one: 6", 8" or 10"; two: 3" and 10"	transformer	$260
derived	n.a.	no	n.a.	no	20	n.a.	n.a.	cascode	1	no speaker supplied	transformer	$200[d]
keyed	n.a.	no	n.a.	no	20	n.a.	n.a.	cascode	1	no speaker supplied	transformer	$230[d]
keyed	n.a.	no	n.a.	no	20	n.a.	n.a.	cascode	1	no speaker supplied	transformer	$300[d]
derived	none	no	IF trap	yes	40	20	n.s.	pentode	n.a.	one: 4" or 8"	transformerless	n.a.
derived	none	yes	IF trap	yes	40	22	n.s.	cascode	n.a.	one: 4", 5¼" or 8"; two: 8" and 10"	transformer	$180
derived	variable	yes	IF trap	n.a.	40	25	n.s.	cascode	n.a.	one: 8" or 10"; two: 8" and 10"	transformer	$260
derived	none	no	n.a.	no	40	18	n.a.	pentode	n.a.	one: 4"	transformerless	n.a.
derived	local-dist.	no	n.a.	no	40	19	n.a.	cascode	n.a.	one: 4" or 6"	transformerless[c]	n.a.
derived	local-dist.	no	n.a.	n.a.	40	21	n.a.	cascode	n.a.	one: 6"	transformerless	n.a.
derived	variable	no	n.a.	n.a.	40	n.a.	n.a.	pentode	n.a.	one to three: 4½"-12"	transformer	n.a.
derived	variable	no	n.a.	n.a.	40	n.a.	15-30	cascode	n.a.	one to three: 4½"-12"	transformer	$250
keyed	variable	no	n.a.	n.a.	40	n.a.	15-30	cascode	n.a.	one to three: 4½"-12"	transformer	n.a.
derived	local-dist.	no	3 IF traps	no	40	23	30	cascode	1	one: 5" or 12"; two: 5" and 12"	transformer	$150
keyed	none	no	3 IF traps	no	40	24	30	cascode	1	same	transformer	$250
keyed	local-dist.	no	3 IF traps	no	40	24	30	cascode	1	same	transformer	$300
keyed	none	yes	3 IF traps	no	40	n.a.	16	cascode	2	same	transformer	$450(27")
derived	none	no	none	no	20	n.a.	n.s.	pentode	1	one: 4" or 6"	transformerless	$140
derived	local-dist.	no	none	no	40	n.a.	n.s.	cascode	1	one: 4" x 6"; two: 4" x 6" and 6"	transformer	$190
derived	none	no	IF trap	no	40	18	n.s.	pentode	1	one: 4"	transformerless	$150
derived	none	no	IF trap	no	40	19	n.s.	pentode	1	one: 8"	transformerless	$190
derived	local-dist.	no	2 IF traps	no	40	19	n.s.	cascode	1	one: 5" or 8"	transformerless	$190
keyed	variable	no	2 IF traps	no	40	23	n.s.	cascode	2	two: 4" and 10"	transformer	$260
keyed	none	yes	IF trap	no	40	22	25	cascode	1	one: 8"	transformerless	$170
keyed	none	yes	IF & FM trap	yes	40	22	20	cascode	1	n.a.	transformerless[c]	$190
keyed	none	yes	IF & FM trap	yes	40	23	20	cascode	1	two: 5¼", 6", 8" or 6" x 9"	transformer	$230
derived	local-dist.	no	IF trap	no	40	21	n.s.	pentode	1	one: 4"	transformer	$160
derived	local-dist.	no	IF trap	no	40	20	n.s.	pentode	1	one: 4" or 6" x 9"	transformer	$190
keyed	none	no	IF trap	no	40	23	n.s.	cascode	1	one or two: 6" x 9"	transformer	$230
derived	none	no	none	none	40	n.a.	10	cascode	1	one: 5¼", 6" or 8"	transformer	$180
derived	local-dist.	yes	none	none	40	n.a.	10	cascode	1	one: 6" or 8"; two: 6" and 8" or 8" with electrostatic	transformer	$230
derived	local-dist.	yes	none	none	40	n.a.	10	cascode	2	one: 6"; two: 6" and 8"	transformer	$330
derived	local-dist.	no	none	no	20	19	25	cascode	1	one: 5"	transformerless	n.a.
keyed	variable	no	high pass	no	40	20	25	cascode	1	one: 5" or 6"; two: 4" and 10" or three: 4", 4", and 10"	transformerless[c]	n.a.
derived	variable	no	FM & 2 IF traps	no	40	20	n.s.	pentode	1	one: 4" or 8"	transformerless	$170
keyed	variable	yes	FM & 2 IF traps	no	40	24	n.s.	cascode	2	one: 5" or 8"; two: 8"	transformer	$200
keyed	variable	yes	FM & 2 IF traps	no	40	24	n.s.	cascode	2	two: 8"	transformer	$300
keyed	none	no	optional	n.a.	40	21	70	cascode	1	one: 5"; two: 4" and 6" x 9"	transformerless[c]	$165[d]
keyed	variable	no	optional	n.a.	40	21	70	cascode	1	two: 4" and 6" x 9" or 4" and 6"; three: 5", 5", 6" x 9"	transformerless[c]	$210[d]
derived	variable	yes	optional	no	40	n.a.	15	cascode	1	one: 4" x 6" or 8"	transformerless	$190
keyed	variable	yes	optional	no	40	n.a.	15	cascode	1	one: 10"; two: 4" and 8" or 4" and 10"	transformer	$260
derived	none	no	none	no	20	20	8	pentode	1	one: 4"	transformer	$130[d]
keyed	variable	no	none	no	20	30	4	cascode	2	one: 12"	transformer	$190[d]
keyed	variable	no	none	no	40	30	4	cascode	2	one: 12"	transformer	$250[d](24")
keyed	variable	no	IF trap	no	40	19	15-20	cascode	1	one: 5" or 10"	transformerless	$160
derived	local-dist.	yes	IF trap	no	40	19	n.s.	cascode	n.a.	one: 7½" or 10"; two: 3½", 5¼", 7½"	transformer	$180
keyed	variable	yes	IF trap	no	40	21	n.s.	cascode	n.a.	one: 7½" or 10"; two: 5¼" and 7½"	transformer	$220
keyed	variable	yes	IF trap	no	40	25	n.s.	cascode	n.a.	two: 3½" and 10"	transformer	$350

man; [c]tube filaments are transformer-fed and wired in parallel; [d]mail-order price excluding freight. NOTE: n.a. means information not available at press time; n.s. means information not specified by manufacturer

NOVEL CABINET has chassis sitting on its end, lets it flop slowly forward for viewing. Telefold, developed by Robert W. Fuldner Associates, New York, can hold any chassis.

[*Continued from page 119*]

The swing is definitely to aluminized tubes. Their phosphor faces have an inner coating of aluminum, which acts as a mirror to reflect the light forward to the viewer. You see a picture four to seven times brighter.

The high voltage on the picture tube is also a good tip to the brightness you can expect. It varies quite a bit among '56 TVs. The higher the better.

Electrostatic focus—automatic—is also taking over the field. Tubes made to operate this way are self-focusing; they have no focus control. But since individual tubes vary, some sets offer the serviceman a choice of voltage connections for the focus electrode. He can choose the voltage that produces the sharpest focus when he is setting up a new set or replacing a picture tube.

You'll hear a lot about "90-degree" tubes. In them the electron beam is swung through a 90-degree angle instead of a 70-degree angle. The advantage is in cabinet-size—90-degree tubes are shorter and fit in a smaller box.

Controls. The only knobs staring at you on a '56 receiver are likely to be the channel selector and those for fine tuning and volume. This makes the set look easier for grandmotherly baby sitters to operate, and helps discourage the kids from fiddling with your carefully worked out adjustments.

For the kind of guy who likes a four-speed manual gearshift on his car, however, a few TVs have all kinds of auxiliary controls available (though concealed) near the screen.

Fringe-area TV. To give you a good picture from a weak signal, '56 TVs use:

• *Cascode tuners (most sets).* These have a specially designed tube with two sections connected so that amplification of the signal is high but noise (snow) from tube operation is low.

• *Automatic gain control (all sets).* AGC circuits sense the strength of the incoming signal and automatically adjust the amount of amplification so that a nearly constant signal reaches the picture tube.

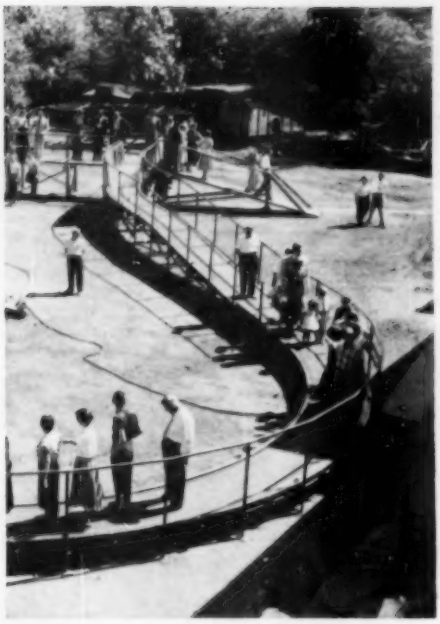
The better "keyed" or "gated" AGC usually involves extra tubes and is more expensive to make. There are many different types, however, stepping up in performance from the simplest derived to the most complex keyed AGC.

Some DuMonts and Capeharts, for example, add to keyed AGC a special video circuit that automatically provides the best possible picture for all signal conditions. On a strong signal, it uses less gain and more band width to provide sharpest detail. On a very weak signal it sacrifices some detail for higher amplification, to provide a picture.

Some sets are actually too sensitive for a strong local signal. Their AGC circuits cannot prevent the amplifiers from overloading and, paradoxically, causing a poor picture. To offset this, you will find that many sets have a manual AGC adjustment. Another method of preventing overload is to put an attenuating pad—a resistor network—in the antenna input. When switched into the circuit, this pad weakens the signal before it gets to the set proper.

• *Noise Killer.* A new circuit is showing up in a few of the quality sets. It is a "noise canceler" or "noise inverter," which ingeniously cancels static that may cause poor spacing of the lines (poor interlace) in the picture and a

[*Continued on page 250*]

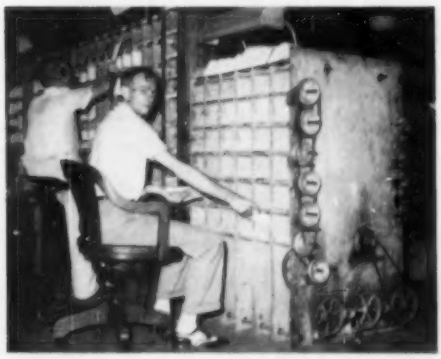


Moving Sidewalk Turns Corners

PASSENGERS ride around curves on this moving sidewalk developed by Hewitt-Robins, Inc., Passaic, N.J. A rubber carpet, fastened to wheeled pallets mounted on steel tracks, stretches on the outside and contracts on the inside as it makes a turn.

Peephole Screens Keep Out Sun

Rows of peephole sunshades will keep sun out of the eyes of tenants who relax on the balconies of these new apartment houses in the U.S. sector of West Berlin. They'll also screen occupants from neighbors but allow limited vision from the balcony.



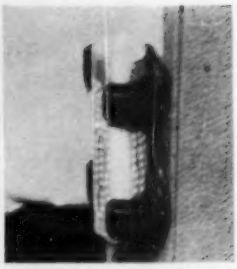
Clerk Mechanizes Mail Sorting

THIS conveyor system devised by post office clerk G. S. Kester Jr. of Columbia, S.C., speeds his work and makes it a sit-down job. A single motor runs moving belts in the pigeon-holes to inch letters to the rear where they are scooped out by hand.

Helicopter De-Ices Phone Lines

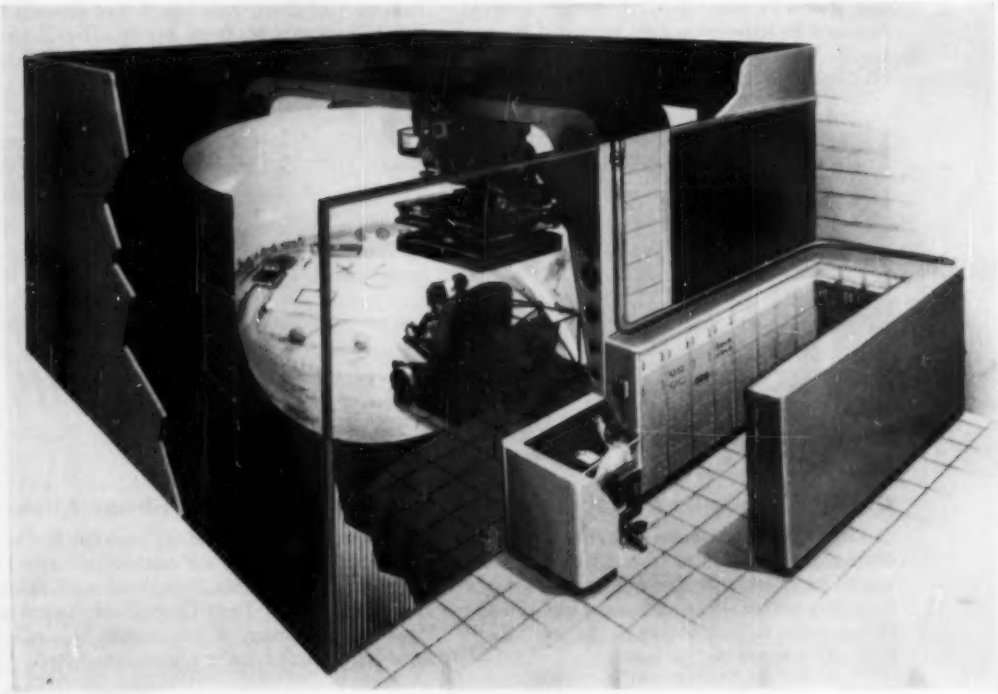
A SPRING-LOADED bamboo pole, hitched to a helicopter, slaps ice off telephone lines to clear service for Pacific Telephone and Telegraph. Economy Pest Control of Yakima, Wash., uses as many as five copters to handle snow-ice control for the phone company.

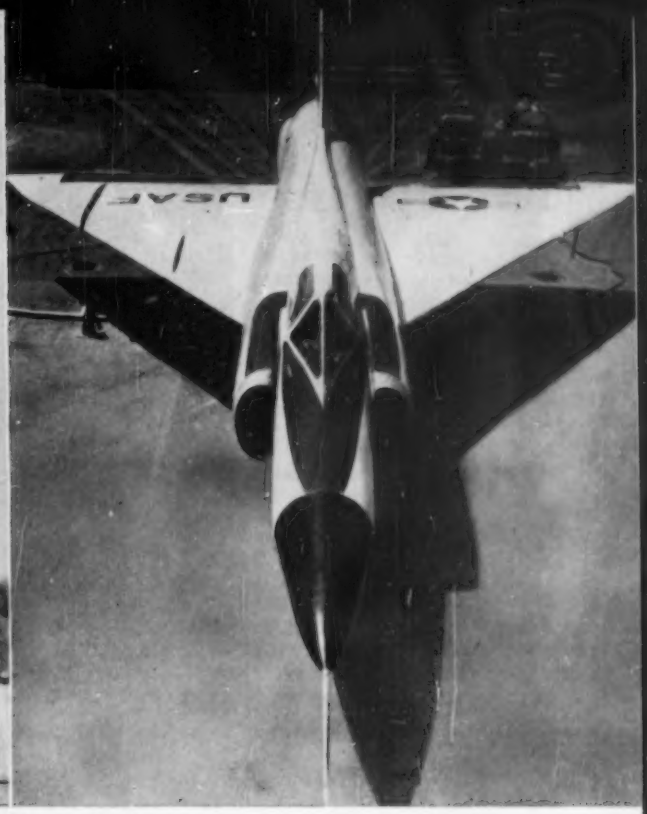
Pilot shifts his weight to control this midget helicopter in flight. A flying test bed, the Kellett KH-15 was developed for the Navy to test a new gyro stabilizing device for rotor craft. Although the KH-15 is powered by rocket motors at the tips of its blade, the stabilizer can be used on any type of helicopter.



A tubelike device will enable cigar and pipe smokers to puff away in Swissair planes without annoying other passengers. The device (above), which is fastened to the seat, contains a chemical to eliminate tobacco and cooking odors and prevent air sickness.

Whirlybird "flight" inside a hangar is possible with this flight simulator, or trainer. Thus a pilot can master the tricky business of handling a helicopter without leaving the ground. Built by Bell Aircraft for the Navy, the device projects scenery as it would look from the air, and duplicates rotor noise, rough air, landing bumps.

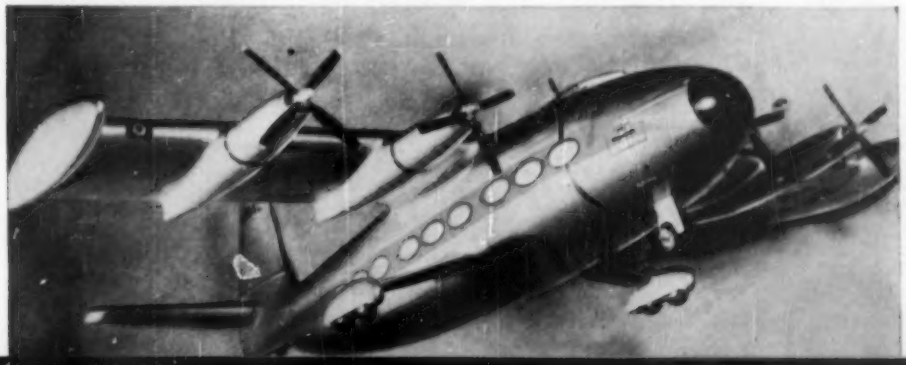




Pinch-waist design, shown in the Convair F-102 all-weather interceptor at right above, enables airplanes to go faster without increasing power. To study flight characteristics of the drag-reducing design, scientists of the National Advisory Committee for Aeronautics used a rocket booster (left) to get plane models up to supersonic speeds.

Mirror and lights guide pilots to safe aircraft-carrier landings. Borrowing from the British, the U.S. Navy is installing this landing system to replace the landing-signal officer. A concave mirror and banks of green and amber lights give the pilot his glide path and altitude in relation to the deck.

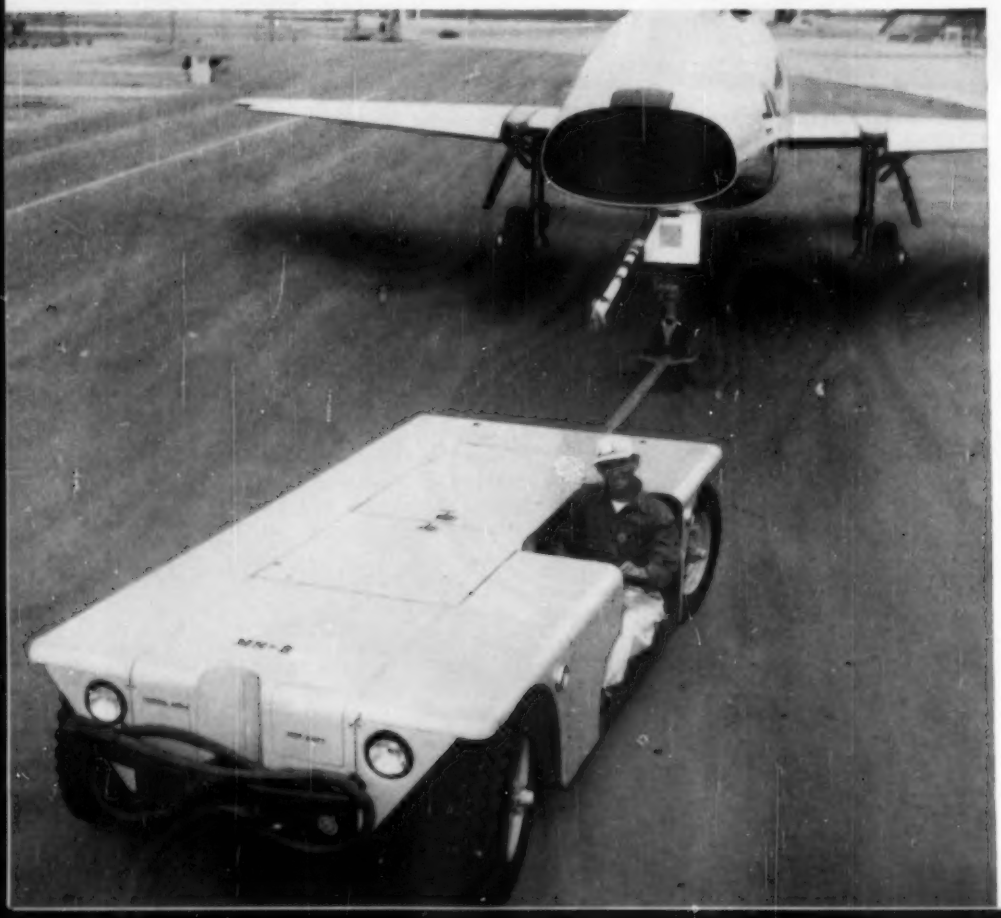
Tomorrow's workhorse of the air, to replace the veteran DC-3, may be this cargo and passenger plane being developed by Jack Frye, former head of TWA and a pioneer in air transportation. With a top speed of 170 miles an hour, it will be able to land at 55 miles an hour on unpaved airports. Landing gear will not retract in flight.

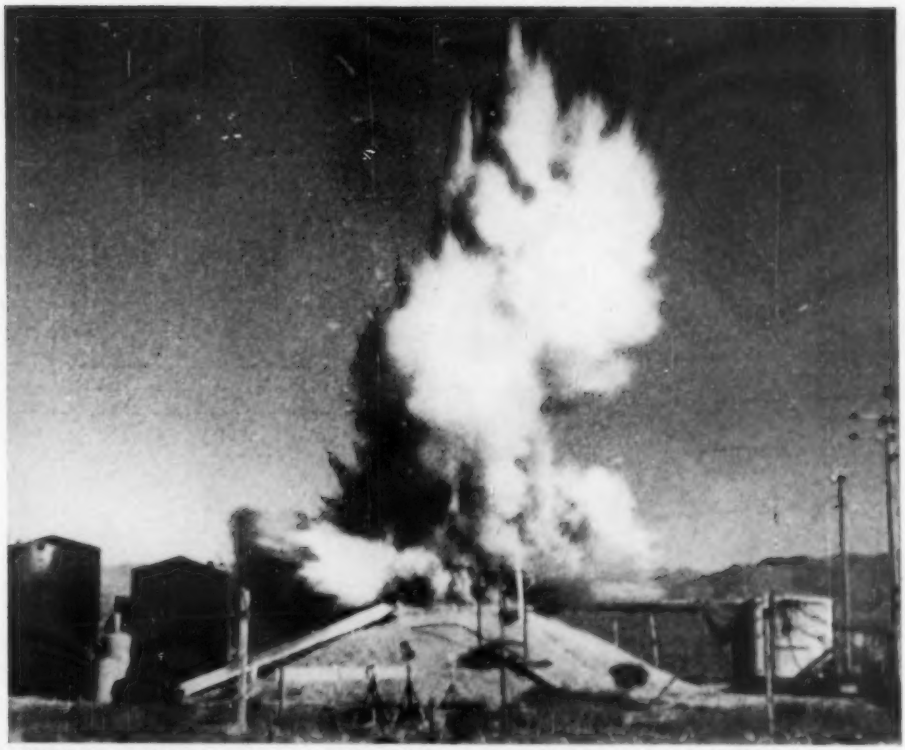


Power Carts Fire Up Jets

Blasts of compressed air from twin gas-turbine units now start the eight powerful engines of the B-52 heavy jet bomber. The small Boeing 502 gas-turbine engines, each with two exhaust stacks, as seen in the photo at right, are mounted on a mobile cart along with a fuel tank. Flexible ducts carry the compressed air to the engines.

Direct power from a gasoline engine, through a hydraulic torque converter, spins jets into life in this North American Aviation unit. The streamlined starter, resembling a sleek sports car, also serves as a tow truck for the F-100 Super Sabrejet below that it is going to fire up. The low-slung vehicle has four-wheel drive and four-wheel steering, and can be driven directly underneath a plane to start a jet engine in 14 seconds.

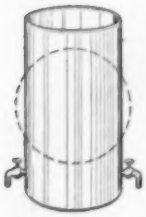




RUNAWAY CHAIN REACTION, staged for safety study, blows up reactor at Arco, Idaho, as output reaches fantastic 13,000,000 hp. Loud detonation spews smoke and radioactive debris.

CRITICAL AMOUNT OF U-235 solution, symbolized at left, undergoes a spontaneous and explosive chain reaction if it is allowed to come together in the most compact shape, that of a sphere.

UNSAFE TANK at left has enough room to contain a sphere of the size above. Therefore, filling this tank with U-235 solution would result in a disastrous, runaway chain reaction.



"GEOMETRICALLY SAFE" TANK has same capacity as tank above. But slimmer shape keeps U-235 solution from forming explosive sphere (dotted outline), and holds it in safely extended form.

Lanky Tanks Avert A-Blast

AN EXPLOSION like the one above is a novel hazard faced by designers of a plant to reclaim costly uranium 235 from a reactor's spent fuel rods. For a solution of U-235 spontaneously undergoes a runaway chain reaction, just as the solid metal does, if a critical amount comes closely together.

So "geometrically safe" shapes have to be used for tanks and chemical vessels handling U-235 solutions at the Chemical Processing Plant of the National Reactor Testing Station, Arco, Idaho, an official report reveals. An elongated design makes it impossible for a critical quantity of the liquid to assume a compact and dangerous spherical form (left).

OUTDOING THE INDIANS, Ross Taylor here fires a flaming arrow from his special compressed-air gun, accurate to 300 yards. It loads three at a time, their tips wrapped in oakum soaked in rubber cement and benzol. A metal disk at each arrow's tip protects the flame in flight.

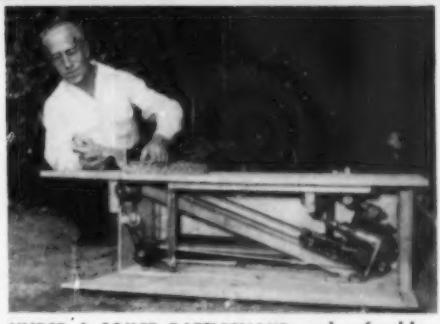
He's Hollywood's Kindest Killer

A 12-SHOOTER AIR GUN (left), Taylor's first trick weapon, fires ball bearings for bullets, to smash lights, mirrors or windowpanes. It also shoots gelatin capsules of red dye (to look like blood), powder, dust (to spurt up around an actor and make it appear that he is being bracketed by bullets) or Vaseline thinned with oil and containing a round black patch of film paper to make an apparent bullet hole (right) and surprisingly realistic crack patterns on flat glass surfaces.

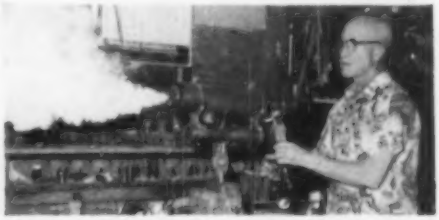
WHEN a movie director wants an actor killed—for plot purposes, you understand—he often selects a weapon from the private armory of Ross Taylor, one of the most gentlemanly, mild-mannered men in Hollywood.

It was mechanical ingenuity and not bloodthirstiness that led Taylor to create better means for shooting arrows, hurling knives and felling people with bullets than the films had had before. Now he has enlarged his battery of safe but lethal-looking weapons to include a mechanical rattlesnake that strikes like its poisonous namesake, and a gun that fires clouds of smoke at the press of its trigger —for asphyxiation or arson, if the script demands it.

Taylor, a former auto mechanic and carpenter, is a special-effects maker for Columbia Pictures Corp. His weapons, all built in his home workshop in North Hollywood, are a lucrative sideline. He rents them to any studio that needs them, for $7.50 a day per weapon, or $35 a week.—*Wesley S. Griswold.*



UNDER A COILED RATTLESNAKE made of rubber lie a fat air motor (at right, above) and lazy tongs, which make it uncoil and strike, and a sewing-machine motor (left) and pulleys that make its tail wiggle. The box is latched shut and buried when the rattler is to be in a movie.



TAYLOR'S SMOKE GUN sprays cold mineral oil under 20-to-40-lb. pressure into a tube electrically heated to 750 degrees F. This instantly creates a thick white vapor, easy to breathe and only slightly odorous. The tube never contains enough oxygen to let the oil ignite.

FOR A THRILLING KNIFE "THROW," Taylor has provided a rectangular-barreled air gun (below), which he is aiming here. Out of camera range, he fires a short-bladed knife at the "victim," protected by a hidden chest pad, the instant that the knife-wielder appears to let fly.

New for Modern Living

1 Ice stoppers keep ice cubes from banging you—and your guests—on the nose when the glass is tipped up for that final sip. Made of colorful, anodized aluminum, the stopper clips inside any glass and holds such things as cubes and fruit away from the lips. A set includes eight colors.

2 Flying saucers fly over snow. Down-to-earth facts show that Sno Coasters are of one-piece 16-gauge aluminum, measure 27 inches across and weigh in at 3½ pounds—about half the weight of a small sled. To operate, grab the two double-riveted handle loops of webbing, shift your weight and you're off—spinning down a snowy slope. Reinforced holes provide tow-rope hook-ons. The saucer won't rust, and Pop will never have to paint it.

3 Music fills the house, drifting through the ducts with the warm or cool air, when you have Registered Music attached to the central system. The case houses a volume control and a speaker. Hooking it up to your radio, TV or record player and mounting it on the heating or cooling unit requires no special tools or skill.

Further information about the products described on these pages can be obtained from: 1. Larsons, 4238 Harwood Ave., Cleveland 21; 2. Aluminum Goods Mfg. Co., Manitowoc, Wis.; 3. Kodiak Corp., 3515 Prospect Ave., Cleveland 15; 4. Imperial Sea-Way Products, 1446 W. Flournoy St., Chicago 7; 5. Orchard Trading Post, Box 151, Skokie, Ill.; 6. A. Schreier & Sons Co., 16 S. Eutaw St., Baltimore 1; 7. Brown-Forman Industries, 1908 Howard St., Louisville, Ky.; 8. Drink-Up Co., 1141 Broadway, NYC 1.

4 Nut meats come out whole, even with tough Brazil nuts and hazelnuts, when you use this tool, says its maker. Smaller jaws on the handles of the Paranac nutcracker take small nuts and crack ice cubes as well. The gadget is also handy for removing bottle caps.

5 No refill cartridges are necessary for this ball-point pen. Ordinary fountain-pen ink, which flows freely into the ball point, can be used to replenish the supply. Ink is admitted by turning a knob concealed in the top of the pen. A transparent barrel section shows ink level.

6 Built-in clasps are now standard equipment on some higher-priced neckties. You make the knot as usual, slip the narrow end with the clasp through a loop under the wide end, then hook the clasp to your shirt. For decoration, you can slide the clasp up where it will show.

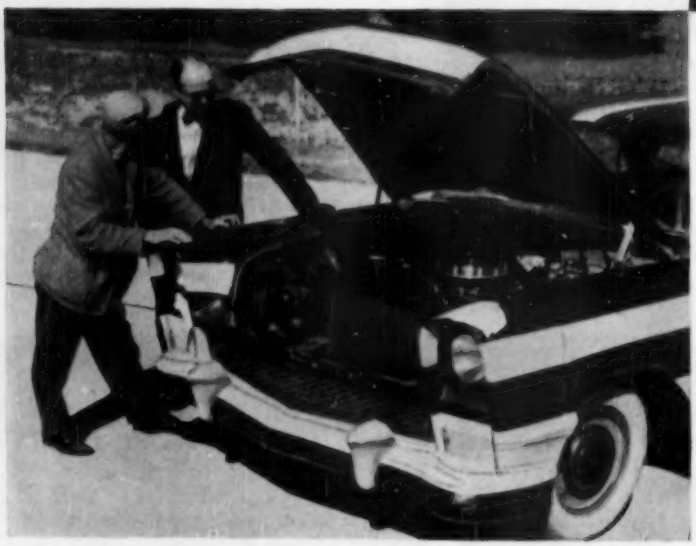
7 Speedy photo chemicals in this setup whip film from developer through wash in seven minutes. All steps take place in the seven removable cups of a lightproof, water-jacket tank. Film (35 mm. to 620) on the reel is fitted into a turret on the revolving lid. An agitating rod dips film in and out of each cup. Floating lids seal chemicals in cups for future use.

8 A reservoir in the base of this planter holds a supply of water (and plant food, if desired) which is absorbed by the soil as it is needed. When plant-watering time comes around, you moisten the soil as usual, then fill the reservoir with an extra supply. A feeding wick running from the flowerpot into the base transmits the water to the plant as the soil begins to dry out.

Chevvy Climbs to 205 Horsepower

The sport sedan is

Compression



STRIPED HYBRID at left is '56 machinery disguised by gooked-up '56 body. Idea was to keep public from learning what new models looked like when car made its record run up Pike's Peak in September. That air cleaner was lifted from a Corvette; the standard power-pack cleaner, like last year's, has a snout forward. Performance is the same with either.

FOR 1956, Chevrolet continues on its performance kick. Its looks are only lightly face-lifted. Its chassis changes are virtually nil. But under the hood on the top-output version is a 205-hp. V-8, which is currently the highest-rated engine in the field. How they pushed the horsepower up from last year's 180 is an interesting story.

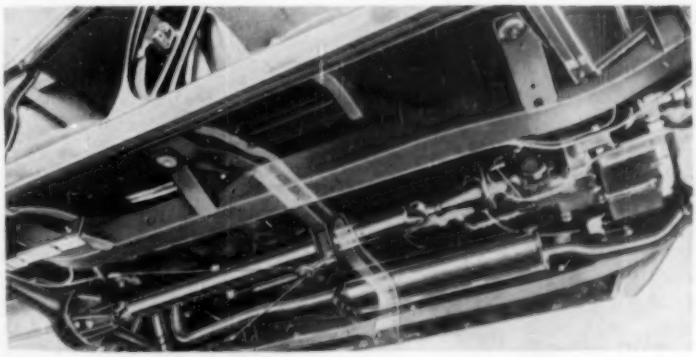
Power pack. The new top-dog Chevvy engine, like its 1955 equivalent, is a short-stroke power plant with a displacement of 265 cubic inches. As before, it has a four-barrel carburetor and dual exhausts. There are two main differences: a new, high-lift camshaft, and an increase in compression ratio from 8:1 to 9.25:1. The 205-hp. rating is achieved at 4,600 r.p.m., the same as last year. Torque is also increased, but relatively less, going from 260 to 268 pound-feet.

Basic V-8. For the bread-and-butter sales, to buyers who aren't performance-happy, there are two standard eights in Chevrolet's line for '56. One, rated at 170 horsepower at 4,400, is for use only with the Powerglide transmission. The other, pegged at 162 horsepower, pairs with overdrive and plain synchromesh transmissions. The torque, 257 pound-feet, is identical on both engines. Each has 8:1 compression, a two-barrel carburetor, and a single exhaust system. The chief difference lies in the camshaft: The

expected to be a hit, combining pillar-less visibility with the convenience of four doors.

and camshaft push up power-pack output, and there's a four-door hardtop for sporty types.

PROBLEM: How do you get center-post rigidity on a four-door hardtop if you cut away the anchorage to the roof? The answer is that you don't get the stiffness of a regular sedan. But deflection is held within acceptable limits by an extra bracing member shown in phantom at the right. There is also a heavy brace above floor at side of the amputated post.



170-hp. job carries the high-lift cam and the other one does not. There is also a minor difference in the spark-advance curve in the distributor, to match the different transmissions.

Old Reliable. There is only one six-cylinder version for '56, for any transmission. The displacement remains at 235.5 cubic inches, but compression has been nudged up from 7.5:1 to 8:1. The engine also has its own version of the new camshaft. The ratings are 140 hp. and 210 pound-feet.

Other changes on Chevrolet engines are minor. The V-8s now come with a full-flow oil filter, tucked down on the left flank of the block, rather than with a partial-flow job perched up high in front. A power-pack V-8 that is ordered with a manual transmission now comes with a special heavy-duty clutch, borrowed from the truck line, to take the roughing-up that a performance-minded customer is likely to give it. The generator mounting has been beefed up to take out troublesome noise. And hydraulic valve lifters are now standard on all engines, in place of the solid lifters that were previously fitted to three-speed cars.

Chevvy engineers are a little sensitive to questions about this lifter change, partly because the solid-lifter engines won a reputation for clatter in '55, and

NINE-PASSENGER WAGON is new. The seat in the back can be plucked out and the one in middle folded for cargo carrying. Access to the rear seat is past a fold-down middle seat.

partly because hydraulic ones aren't beloved by high-performance customers. The engineers take pains to spell out two points:

1. Exacting manufacturing controls are making hydraulic lifters much better performers than they were a few years back, when lifter "pump-up" could occur as low as 4,500 r.p.m. This speed ceiling has now been pushed up to where run-of-the-assembly-line lifters will tolerate 5,200 to 5,300 revs, and a selected set can go to 5,500.

2. If, despite such assurances, a prospective customer stubbornly insists, he can have Corvette-type solid lifters on request.

JIMMY VALENTINES may be needed to work gas-cap combinations of new cars. Chevvy combination: Twist trim just above left stop light.

Performance. The only '56 job that was available five weeks before announcement was a beat-up car that Zora Arkus-Duntov had used in setting a record up Pike's Peak. It had a standard shift, hydraulic lifters and a slightly tired clutch that was not the new heavy-duty type. Pulling a fifth wheel to give correct speed, it delivered zero-to-60 runs of from 11.4 to 11.9 seconds (the variation being attributable to the sick clutch). The fifth wheel, incidentally, underlined the worthlessness of casual speedometer-clocked runs: Judged by the speedometer alone, the car made a 9.9-second run.

This performance is a whisker better than last year's, which was very good indeed. The short-stroke engine doesn't threaten to blow its buttons if you wind it up to 5,500 r.p.m., well beyond the peak. This means that on a zero-to-60 acceleration with this axle, you can forget about shifting to high. Although performance is showy, Chevvy may not in '56 have things all its way. Ford for one has the benefit of far more cubic inches and, on automatic-transmission models, a box that can give one extra gear change.

Safety latches, belts. Foxy as always, Chevrolet stole a march by inconspicuously introducing "anti-fly-open" door latches as a running change in June and July of 1955. The new models now offer either safety belts or shoulder harnesses as extras, as well as dash padding. The steering wheel has not been changed from its '55 configuration.

Sport sedan. New this year is a four-door hardtop, with no center pillar in the window area. Extra bracing stiffens the half-height post on which the rear door hinges and the front door latches. It comes in both the flossy Bel Air and middle-brow 210 series. Another '56 development is the introduction of a nine-passenger wagon.—*Frank Rowsome Jr.*

You'll Hardly Know the New Studebakers

New lines, a new engine and a theatrical new bomb are the '56 wares.

NEW NOSE reminiscent of Italian school marks the Hawk line of low-silhouette five-passenger coupes.

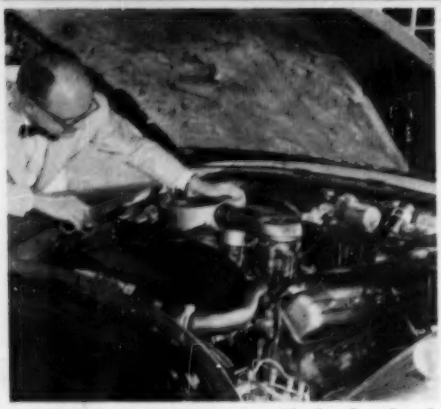
By FRANK ROWSOME JR.

PRACTICALLY everyone, it has been morosely noted in South Bend, likes Studebaker in principle. A little company struggling with giants, it has a proud history of engineering quality and innovation. Lately it has offered some of the slinkiest cars ever to turn up in U.S. salesrooms. But this academic approval has not been widely translated into twitches of the check-writing fingers.

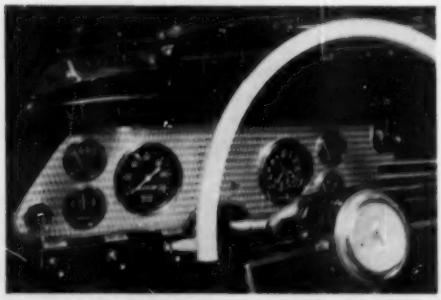
The '56 jobs have been recalculated to correct this behavior:

- The slopey, Loewy-designed coupe is

NEW RUMP gives more luggage space. The Sky Hawk and Presidents get the new 289-inch V-8.



HEADROOM IS A HEADACHE with that low hood, but on Studebaker-powered Hawks, engine accessibility is better than on some competitors. Blanket is offset to clear new 12-volt battery.



NO-NONSENSE GAUGES come on the Hawks, in contrast to winking lights and moving lines on sedans. Studebaker figures that the buyer of a low-silhouette car likes instrumentation.

no more. In its place is a different, though still highly sexy, line of low-silhouette coupes called the Hawks. In ascending order of dazzle they are called the Flight Hawk, Power Hawk and Sky Hawk.

• Sedans have new rectangular lines, reminiscent of several successful competitors. The design replaces one that attempted to pair the hardtop's slinkiness with sedan proportions, and that didn't hit the bull's-eye. The '56 sedans promise to be more popular.

• Wagons, now strong medicine in the big suburban trade, have been expanded from the lone Conestoga of the past to three new ones. They are, in ascending order of glory, the Pelham, Parkview and Pinehurst. (Buyers not sharp at this model-christening caper are going to insert Ford's new Parklane wagon here.)

• In the machinery department, Studebaker offers such additional enticements as a new V-8 that is 30 cubic inches larger, an improved ride, better brakes, new safety door latches, a new automatic transmission, and enough optional assists to coddle a driver enfeebled to the point of collapse.

• Then there's an ace up the sleeve: the Golden Hawk. This is a limited-production special, even creamier than the other Hawks, that has a monstrous 352-cubic-inch Packard engine shoehorned under the hood. With some 275 hp. to urge a comparatively light car, its acceleration and top speed will peel the smug smirk off many a Thunderbird owner's face.

New automatic. The publicity will not drum it in, but the new Studebaker transmission is virtually identical with Ford's. It differs in two respects: The selector quadrant remains PNDLR (leaving Ford-built cars in lonely status with their PRNDL), and it *always* starts up in low, not just when you boot it through the detent. The latter trait gives the car uncommon liveliness in heavy traffic. Studebaker engineers emphasize that this does not cost extra gasoline. Their explanation: A converter-plus-low start involves lesser throttle openings and less heat rejection than a converter-plus-second start, which, to produce identical acceleration, needs both a wider throttle and more oil churning.

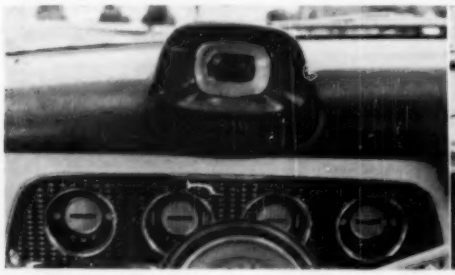
SLICKEST WAGON that Studebaker has ever built is this new Pinehurst. A six-passenger job, it gets the full treatment in fancy trim and fittings. Power plant is the 289-inch V-8, with any transmission. There are two less expensive wagons, with smaller engines and plainer trim.

The sedans, squared up to suit the current taste, are handsome. There are many vivid color combos.

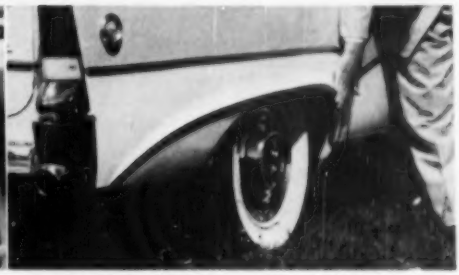
Champion six makes the gas go a long way.

Commander uses the smaller, 259-inch V-8.

The President Classic is the de-luxiest sedan.



THAT'S NO COMPASS, it's a speedometer. Figures are green to 35, yellow to 60, bright red thereafter. A vertical-drum speedometer somewhat like this wasn't unusual 25 years ago.



THOSE FLARING FENDER LINES may look as pretty as all-get-out when the car is brand-new. But if your lady is a garage-scraper, they're going to change from clean lines to frazzled ones.

With this new transmission Studebaker drops the direct-drive lock that it has had for years on its automatic. The reasoning here is simple: The lock-up has been a fine gadget in theory but modern converters have so little slip at highway speeds that the extra cost and complication aren't justified. Without it, moreover, there's a trifle more zip.

The V-8 is stroked. In the engine room you can now have a choice of three different mills, not counting the Packard:

1. A 185-cubic-inch L-head six, available in Champion sedans, Pelham wagons and Flight Hawk coupés. Rated at 101 hp., its performance will not terrify you, though it runs endlessly and cheaply.

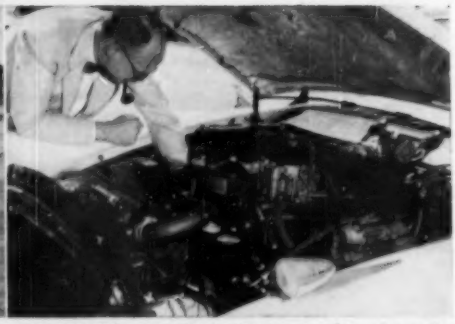
2. A 259-inch OHV V-8, available in Commander sedans, Parkview wagons and Power Hawks. Changed only in minor carburetor details from last year's bigger engine, it is rated at 170 hp.

3. A 289-inch OHV V-8, for Presidents, Pinehursts and Sky Hawks. The bore is the same as on the smaller V-8 ($3\frac{9}{16}$ inches), but the stroke has been stretched from 3¼ to 3⅜ inches. This engine has a new crank and pistons, of course, and slightly different main bearings. As on all Studebaker engines, the buyer can choose between compressions of 7.5 or 8 (it amounts to about the difference between gas grades). Horsepower: 190.

Medium-grade zip. For those who must have extra git (210 hp.), Studey provides a four-barrel carb and a dual-ex-

Don't drag-race with this Hawk

HANDWRITING ON THE REAR identifies the hot one. In side view (top) look for the chrome stone shield under the door. A drive-for-kicks car, it seats five and carries their luggage.



BIG MOUND OF MACHINERY results when the huge Packard-built 352-incher is crammed under the hood. Car shown above has power brakes and steering; others aren't quite so crowded.

haust system as an extra-price option on either V-8. (On one fancypants President, the Classic, the power package is standard.) It gives plenty of go; on a beat-up engineering car having the larger V-8, this writer clocked zero-to-true-60 accelerations of about 13.3 seconds with four men aboard. Although not the most theatrical getaway in the '56 field, this is still exhilarating.

All new sedans have twin pipes peeping out the back bumper, a fact that may baffle alert tailpipe observers, especially when they notice that no smoke ever emerges from the left one on any Champion or many Commanders. But you will not get the Studebaker engineers to blush over providing this dummy pipe. They simply smile blandly and point out that it is a lot more sensible to provide one dual-accepting rear bumper throughout the sedan line and then fit a stub dummy pipe on single-exhaust jobs.

On Hawks, that hood bump that seems to provide carburetor air is also a dummy. All V-8s breathe via a big, tubular cleaner that slants over the right cylinder bank. Studebaker engineers, harassed by a low hood, keep a fretful eye on the breathing problem. They claim that on the 352-inch prestige job the cleaner eats only three horsepower at top output.

Finding space in the engine compartment remains a critical problem; they even had to shift the hood insulation blanket to one side to clear the top of the 12-volt battery. Any mechanic who

[*Continued on page 246*]

Dynaflow's New Trick Peps Up 1956 Buicks

They get away faster at the light and go farther on a gallon of gas.

By DEVON FRANCIS

BIG STATOR WHEEL (indicated by arrow) is the newest improvement on Buick's automatic transmission. It redirects the oil flow for more push at the rear wheels. The smaller primary stator is at its right.

NEW FRONT FENDERS and grille are part of styling changes on '56 Buicks. The hood ornament is a chromed jet bomber. The grille ornament is a winged circle containing year and car series number.

WELL, they've gone and done it again at Buick—revised that automatic transmission, that is.

For 1953 they put gears inside their Dynaflow drive to step up acceleration.

For 1955 they put a variable-pitch thing in it to step it up some more.

For 1956—the new cars were announced last month—they have put a fixed-pitch thing in with the variable-pitch thing to step it up *still* more.

It pays off. The 1955 Buick Super took 11 seconds to go from 10 to 60 miles an hour. The 1956 Super does it in 10.1 seconds. The new Special does it in 12, the Roadmaster in 10.7 and the jackrabbit Century in 9.8.

Power and torque help, of course, but anybody who discounts the push of that

A rear-view impression: full-wheel fender cutouts framed in chrome strips

FULLY EXPOSED WHEEL is outlined at top by a flat strip of sweeping spear molding carried through to the tail lights. Series designation has been removed from rear fenders. Chromed housing for lamps is heftier. Reflector is at center of "V," and backup light positioned below it.

SUSPENDED BRAKE PEDAL makes for better body seals, fewer drafts. It also improves pedal action and gives linkage better protection from weather. Rear brakes are a half-inch wider.

JACKING POINTS—at long last!—are now on frame side rails. Jack can be foot-operated. Photo shows rear wheel being raised. For front wheel, jack fits under rail inside bumper guard.

refurbished transmission has got a head that's out-of-round.

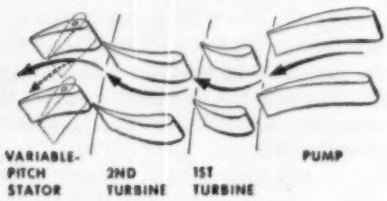
The transmission saves gas, too. The company is now so proud of its gas mileage that it's publishing the figures.

At a steady 20 m.p.h., the Super for '56 gets 19.5 miles to the gallon as against 19.3 in '55—with the same rear-axle ratio. At 30 it gets 19.9 and at 40 it gets 19.3, both better than last year. Beyond those speeds, there's no change.

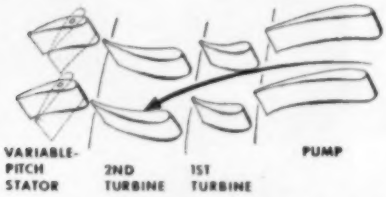
The other cars in the line also show improved fuel economy in the same speed ranges, although only the axle ratio of the Special has been changed (favorably) over '55.

What Buick has done to its transmission is to add a fixed-pitch stator. Stators are those pieces of hardware in a torque converter that redirect the flow of oil so that it will multiply the torque effort of the engine. Conventional transmissions multiply torque with gears. Torque converters do it with pumps, turbines, stators *and* gears.

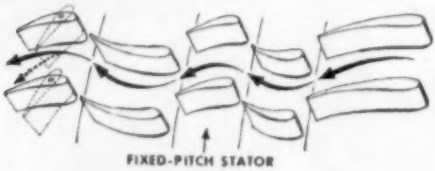
Heretofore, using only the variable-pitch stator, a first turbine in the Dynaflow transmission was pooped out by the time a second turbine began operating. This was the way the oil flowed in the '55 transmission when the first turbine was manufacturing torque:



And when the first turbine began rotating at the same speed as the pump, this was the oil-flow pattern to the second turbine:



Here is the oil flow for '56, with the added stator permitting the two turbines to work together:

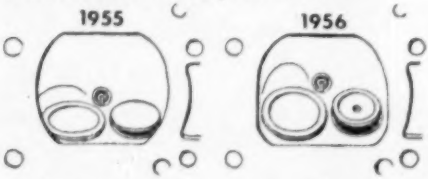


They did one other thing to the Dynaflow. Through 1955, you could get extra push at the rear wheels with that variable-pitch stator only in Drive range. In the 1956 cars, you can get extra push in Low range, too.

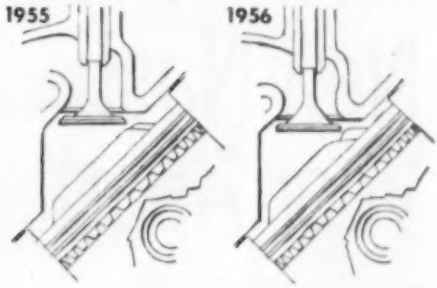
A lot of other changes, none of red-alert importance, but adding up to better performance, comfort and appearance, also have been made in the new Buicks. Direct-acting shock absorbers cushion the ride better. A dual-exhaust system, optional in some instances, increases torque for passing. The Special's rear brakes are bigger.

Horsepower? You should ask! It's up, of course. The Special is at a measly 220 horsepower, up 32, and the Super, Century and Roadmaster are at 255, up 19.

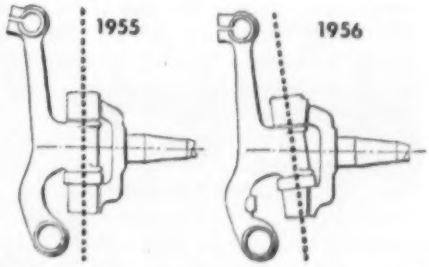
One of the ways they got the additional power was to change the shape of the combustion chamber, like this:



They upped the compression ratios, changed the cams and fixed the exhaust manifolding so that it's easier for the burned gases to get out of the cylinders. There's better valve clearance at the cylinder heads. Here's how:



Then there's the front suspension and steering. The new cars take a little more muscle to force into a turn. They "understeer," as the engineers say. The steering arms are the same as those in 1955, but the ends have been raised a quarter of an inch. Directional stability has been improved by changing the inclination of the kingpins, like this:



The power steering is improved. With an over-all ratio of 17.5-to-1, the gear gets more boost from the power unit. The hydraulic oil is used as a lubricant, eliminating the need for greasing. A six-way power seat is offered as an option, and notwithstanding the fact that GM is soft-pedaling safety, you can get seat belts if you want them.

The air-conditioning unit—also optional, of course—is now all snugged into the engine compartment instead of being divided between there and the trunk.

All the new Buicks have wheel cutouts on the rear fenders for that sporty look; and in case you wondered, Buick's trademark fender holes are retained. For '56, they're oval. END

New Hudson, New Nash Veer Apart

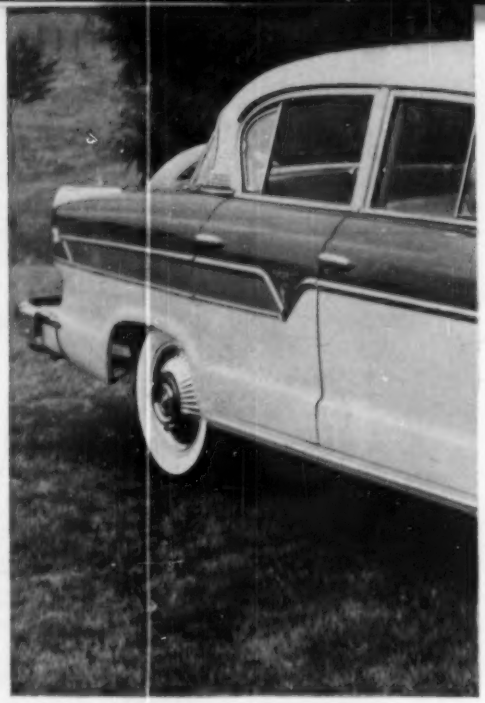
These brother autos now offer more individuality in styling, new luxury, higher horsepower.

A LITTLE more of everything, from torque to tones, is the word from American Motors on its big cars for 1956. The planned dissociation of Hudson and Nash in appearance, despite the use of many of the same body parts, is perhaps the biggest change this year. Hudson's front and Nash's rear have been heavily modified, and this, combined with divergent detail and trim, successfully hides the structural kinship.

Hudson engines. At the top of the heap is a big V-8. Built by Packard for American Motors, it is a 352-inch engine rated at 220 horsepower and 320 pound-feet of torque. (Last year's figures were 208 hp. and 300 pound-feet.) With a compression ratio of 9.55:1, it wants premium gas. It shaves a solid second off last year's zero-to-60 time, bringing it down to 12.5 seconds true. The engine comes only with Packard's automatic transmission.

For calmer buyers there's the big L-head six, rated at 165 and 175 horsepower, depending on carburetor option. It likes regular gas, has a respectable 278 pound-feet of torque and can be had with a synchromesh box, overdrive or Hydra-Matic. Principal changes: new camshaft, hydraulic lifters, a 12-volt system. Hudson also offers a smaller L-head six, rated at 120 and 130 hp. It has the same transmission options.

Nash engines. At the top is the same



Major face-lift up front changes the looks

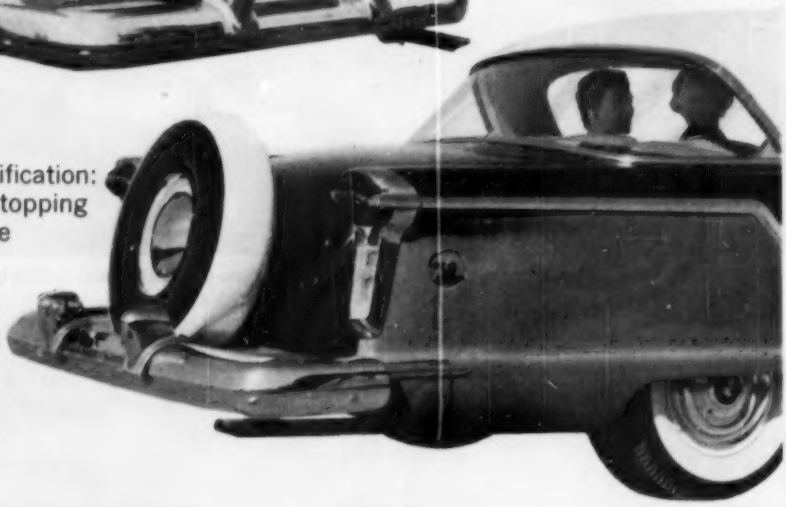
New Nash, also urged by a 220-hp. mill,

of the new Hudson, which can be had in three-tone paint combos. A 220-hp. V-8 engine runs it.

shows less change in styling of front. Inboard headlights remain an easy identification feature.

New rear details also change the look of the Hudson Hornet going away

OUTDOOR SPARE, though standard on fancy models, isn't obligatory; buyers with short garages or chaste tastes can have it tucked inside the trunk compartment. The chrome-finned tail lights and back-up lights are redesigned.



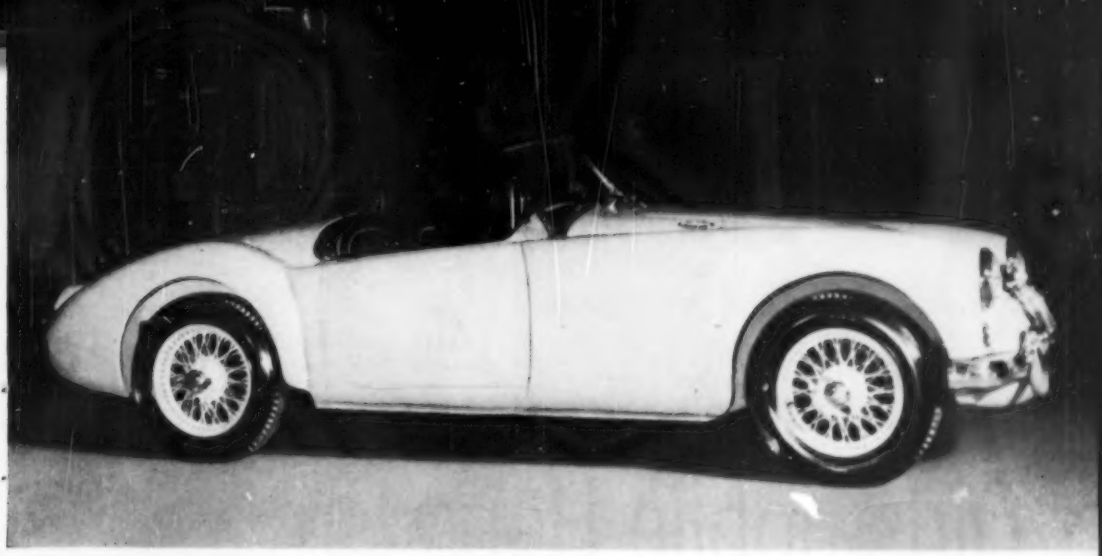
For '56 Nash identification: monster tail lights topping a higher fender line

IT ADDS 10 INCHES to the 209¼-inch over-all length of the Ambassador to let that spare hang out in the cold. (It also adds two cubic feet of luggage space.) Seat width is ample: 65 inches in front, 64½ inches in the rear.

BYE-BABY FRONT SEATS, which loll back in easy stages and drop flat for full-bore snoring, remain a prized feature for Nash and Hudson. Car shown had doorpost removed for picture.

Packard-built 220-hp. job. Next comes Nash's OHV 6, with a displacement of 252.6 cubic inches. If laden with one carb and the title "Super Jetfire 6," it puts out 135 hp.; if given two pots and the name "LeMans Dual Jetfire 6," it is provoked into delivering 145 hp.

For its less expensive models, Nash uncovers a brand-new engine, a tiny but high-output OHV six. With a displacement of 195.6 cubic inches, it socks out a respectable 130 hp. at 4,500 r.p.m. This gives the car substantially more sass than last year, when it came with L-heads of 100 or 110 hp. The new job has a bore of 3⅝ inches, a stroke of 4¼, compression of 7.44:1, and a sparing appetite for regular gas. It should come as no surprise to see this engine, with different carburetion, in the 1956 Rambler. END



MG Gets Curves, Power, Performance

SEARCH as you may, it's hard to find a straight line on the new MG, latest model in a series of hitherto uncompromisingly angular little roller skates. The MG Model A, as extensively rounded as a pin-up girl, now looks like many another imported sports car. It will be readily confused by the inexpert, or the indifferent, with the Austin Healey 100.

Beneath the skin there are changes, too. The permissible revs have been pushed up to 5,500, and the car will now willingly top 90 m.p.h. All ratios within the four-speed gearbox have been modified, and the little two-seater now runs with a 4.3 rear axle in place of the previous 4.875.

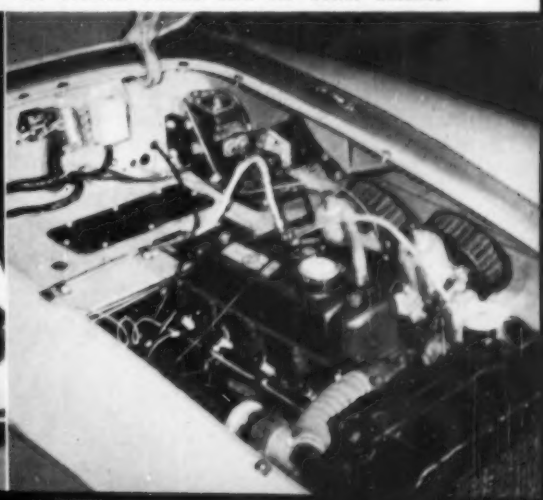
The engine is subtly modified from its TF 1500 predecessor, which was almost a fifth bigger than *its* predecessor:

	Model A	TF 1500	Change
Bore	2.875″	2.834″	+ .041″
Stroke	3.5″	3.54″	− .040″
Disp. (cu. in.)	90.88	89.45	+1.43
Hp.	68	63	+5

While steering and suspension remain nervously alert in the best MG tradition, comfort is now catered to: more leg room, larger luggage space and, for the first time, a real gasoline gauge.

THIS IS AN MG? Hardened owners of TC models will frown at such departure from austerity as the metalized fabric cover on the inside spare. Deck lid has a remote-controlled latch.

BUSY LITTLE BEE still buzzes under the bonnet. One unit of dual master cylinder in background operates clutch. The batteries (there are two) are located behind seat for better balance.



1949

HIGH COMPRESSION V-8 was new idea when Jack Wolfram, then chief engineer, introduced engine.

1956

BASIC ENGINE, unchanged, has same block, rods, bearings, crankshaft. Wolfram now heads Oldsmobile.

Oldsmobile Hops Up That Engine—Again

Subtle changes from year to year since 1949 have boosted its horsepower by a whopping 105.

ONCE each year, when summer's dog days descend upon the land, a couple of fellows who act like tourists climb into an automobile at Lansing, Mich., and set off on a long safari.

If they have any fun, it's only incidental. They have a mission. They are field-testing gasolines all over the U.S. with an Oldsmobile engine that has a compression ratio intended for introduction 18 months later.

The information is important. On the antiknock quality of the gasolines available depends how high automobile-engine compression ratios can go more than a year hence. In turn, on *that* depends, largely, what power can be built into engines.

The year-to-year findings of the traveling men from Lansing are of more than passing interest to Olds: It was the company that in 1949 sparked the industry in building the postwar hothead V-8s. Olds marked out the starting line for Detroit's all-out "horsepower race."

The results of the 1954 trip by the tourists from Lansing showed up last month when the company introduced its 1956 cars. Its top engine bulged at 240 horses. That was 105 horses more than Olds had boasted seven years before from what looked, outwardly, like the selfsame engine.

Other gains between 1949 and 1956 are impressive. Along with horsepower, the torque—which determines the push at the rear wheels on take-off—has skyrocketed. In 1949 it was at 263 foot-pounds. In 1956 it's at 350 foot-pounds.

The car has knifed 3.2 seconds off its acceleration time from a standing start to 60 miles an hour, despite the fact that it weighs several hundred pounds more.

And even with that added weight, it gets more miles to the gallon of gas than it got in 1949.

Something has happened in those seven years. What is the source of so much more power on less gas? Just as

THIS IS THE WAY THE HORSEPOWER GREW:

1956 Ratio put at 9.25:1, carburetor enlarged, intake manifold modified, piston weight increased, rings improved, cam and distributor redesigned, exhaust ports widened. — **240 HP.**

1955 Ratio upped to 8.5:1, combustion chamber redrawn around exhaust valves for better breathing, valve lift boosted with modified cam. — **205 HP.**

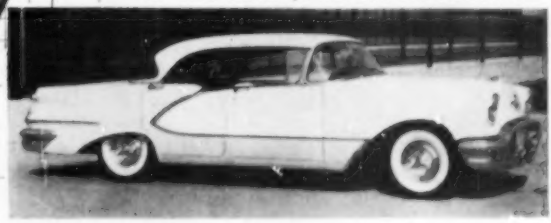
1954 Ratio increased to 8.25:1, displacement from 303 to 324 cubic inches, manifolding and valve ports enlarged, valve lift boosted, rings chrome-flashed. — **185 HP.**

1953 Compression ratio upped to 8:1, 12-volt electrical system installed. — **165 HP.**

1952 Valve lift increased, camshaft modified, piston weight boosted, four-barrel carburetor added. — **160 HP.**

1949, 1950, 1951 Horsepower was static: Olds had no competition. Boost in compression ratio in 1951 to 7.5:1 raised power but Olds did not advertise it. — **135 HP.** **135 HP.** **135+ HP.**

THE 1956 LOOK: This four-door hardtop in de luxe "98" Holiday version is the fanciest of Olds' models, announced last month.



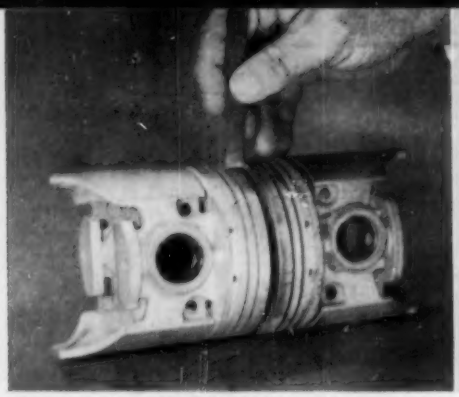
important, how much additional power can this engine yield in the future?

The first question was answered in advance on August 18, 1948, when technicians from the General Motors research labs told a Society of Automotive Engineers meeting in San Francisco that high-compression engines promised "large gains in fuel economy" if better gas became available at a reasonable price.

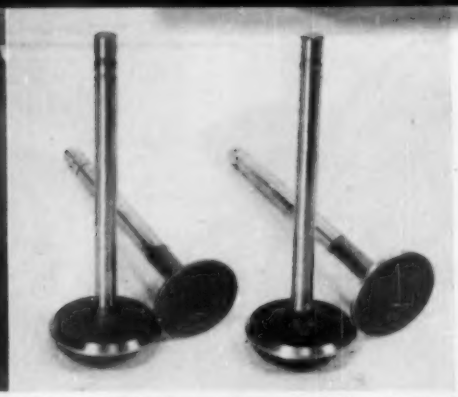
Experiments by Charles F. ("Boss") Kettering, GM's aging but still sassy consultant, were what they were talking about. Ket had boosted miles-per-gallon by a third with an engine that he had pushed up to a 12.5:1 compression ratio.

The oil companies read the San Francisco statement with a bilious eye.

"When we talked about 95-octane fuels," an Olds engineer recalled the



PISTON HAS GROWN ⅛ inch in diameter and increased 52 grams in weight in seven years. Original V-8 weighed 5.52 pounds per horsepower; newest version weighs only 3.2 pounds.

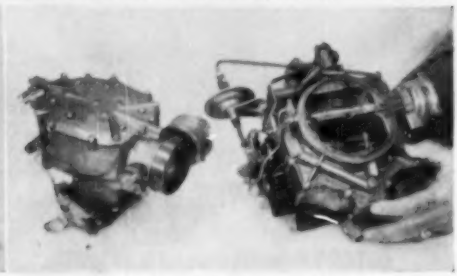


VALVE SIZES have changed little. Original intake and exhaust valves (left) measured 1¾ and 1 7/16 inches. Latest intake is the same, but exhaust valve has been increased ⅛ inch.

Four ways the Olds engine has changed in seven years

MANIFOLDING in 1949 (left) showed sharper turns than that in 1956 engine, reflecting effort to "open up" breathing. Dual exhaust systems are optional on all models for '56.

NEWEST FOUR-BARREL CARBURETOR (right) is big-throated compared with two-barrel original. Compression pressure has gone up for six years. In 1949 it was 200 pounds; now it's 258.



other day, "the refiners made mouths. They figured that they had done pretty well in producing 90 octane for cars. They said that it would take years and years to push it to 95."

But Olds already was plowing ahead with an overhead valve, high-compression V-8. Its old L-head straight eight was at the end of the road.

Prototype engines, sheathed in yesteryear's sheet metal and sent out on the road for tests, had to stop at airports for the high-test gas that their finicky appetites required.

The new engine was announced in December, 1948. It had a compression ratio of 7.25:1 as against the old engine's 6.7:1. Smaller, more compact, it weighed only 5.5 pounds for each horsepower produced, against 6.2 pounds in the straight eight. It produced 135 horsepower against 115.

And it got almost 19½ miles to the gallon of gasoline at a cruising speed of 50 miles an hour, contrasted to 17½ miles for the old engine.

"The engine," said POPULAR SCIENCE MONTHLY in its issue of January, 1949 (p. 167), "promises to pace a revolution in gasoline-fed automotive power plants."

It fulfilled that promise. As late as 1951, the average horsepower of U. S. automobiles was only 117. For 1956, it's more than 225.

How did Olds—and the rest of the industry—do it?

Better fuels, of course, keyed the advance. The refiners are years ahead of their own guesstimate. In 1948 the national average octane for "regular" gas was 70. That for premium was 90. This was suitable for engines within the 5-to-1 to 7-to-1 compression range.

[*Continued on page 260*]

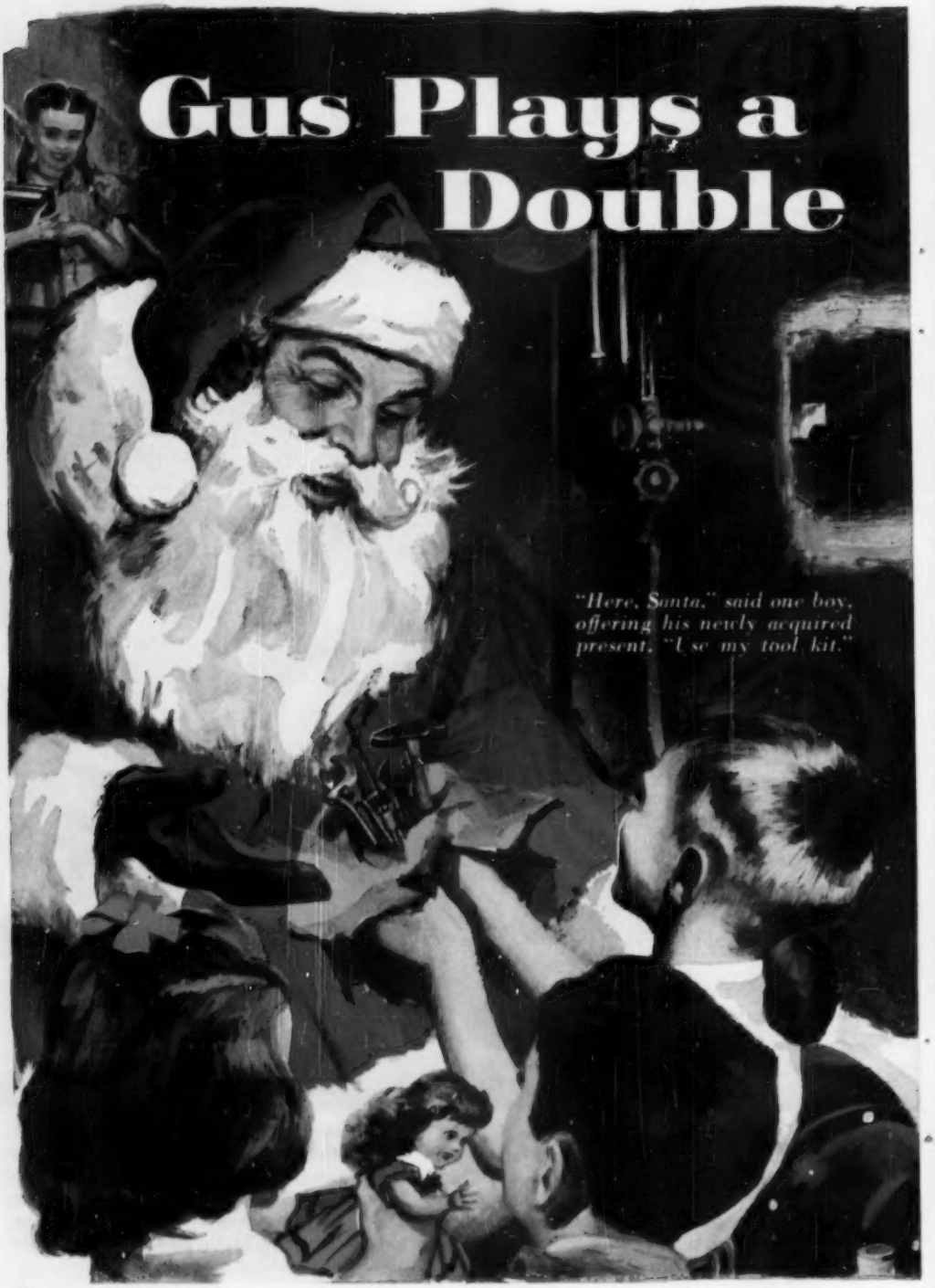
New Tricks of the Trade in Cars Abroad

Stylist's Own. U. S. designer Raymond Loewy shows two-seater Jaguar that he styled for himself. It has a roof opening, all-around visibility, a jump seat, extra luggage space.

One-Piece Gate. A large rear window in this British Humber Hawk station wagon cranks into the tailgate from outside. Thus it can be partly opened for ventilation or, as here, be retracted out of sight. When the tailgate is opened, a spring-loaded floor panel slides over the hinges to make loading easy.

No Back-Seat Driving. Riders in the rear of this four-passenger German midget face backwards. Doors, front and back, flip up to ease crawling in and out. The Dornier Delta has a one-cylinder, 14-hp. engine under the floor in the middle. It can do about 50 m.p.h., costs around $700.

Gus Plays a Double



"Here, Santa," said one boy, offering his newly acquired present, "Use my tool kit."

Role

The master mechanic works under wraps to rescue young faith in Christmas miracles.

By MARTIN BUNN

GUS WILSON, genial proprietor of the Model Garage, was having the time of his life. He was playing his usual role of Santa Claus for the Christmas festivities at the elementary school. Gus made an imposing figure as he moved among the happy, excited children, distributing gifts from the bulging pack on his back, red stocking cap worn at a jaunty angle, white beard flowing down upon his pillow-stuffed front.

Gus was getting along famously with the kids when Miss Davidson, the principal, approached him with such an expression of panic on her face that Gus feared she was about to speak his name and give him away.

"The heating plant won't run, Santa," she told Gus, "and we can't reach a furnace repairman. They all seem to be away for the holiday. It's getting awfully cold in here. What can we do?"

Glancing through the open door of Miss Davidson's office, Gus could see Matt Bergstrom, who was a member of the school board, frantically jiggling the phone hook as he tried to get a number. Sam Howard, the school's janitor, stood beside Matt, wringing his hands helplessly. Gus, heavily padded, had not noticed the cold.

This was a big evening for adults and kids alike. The walls of the school were gay with decorations. A huge tree sparkled with lights, and from its tip shone the silver star of Bethlehem. The school stage, where every year for over a quarter of a century the town's youngsters had presented a Biblical play, was decorated with star-studded evergreen wreaths.

Gus tousled Tommy Willard's mop of hair as he thought about the problem.

"Here you are, my lad," he boomed, handing the boy a present.

Turning to tiny Ann Trotter, Gus permitted a worried expression to come into his eyes. The child, her arms outstretched to take the gift Gus was offering, saw it. Her blue eyes opened wide in dismay and astonishment. This will never do, Gus thought.

"And now for you, my little lady," Gus said in

his best Santa Claus voice, boosting the tiny tot to his shoulder, "I have this doll with real hair and eyes that close."

"I'm getting awful cold, Santa Claus, and my baby is, too," she said as she cuddled the doll in her arms.

MATT Bergstrom stepped from Miss Davidson's office, and his eyes met Gus's in mute appeal.

"A nice state of affairs," someone in the audience grumbled aloud. "It's freezing cold in here."

The eyes of the adults strayed to Gus. Here was a man to whom they had been accustomed to turn in times of emergency.

Gus sighed. What could he do? He couldn't step off the stage with his presents still undistributed. Neither could the Santa Claus these kids had known for years suddenly turn into Gus Wilson of the Model Garage—the man who fixed daddy's car.

Besides, he knew little about automatically controlled oil-conversion units like the one that had been put in here. And yet, he did know something. He had been on the committee that had selected it. He had gone over its specifications rather thoroughly with the salesman. At any rate, he had to make a decision now, and he made it.

"So," Gus roared jovially, chucking little Ann Trotter under her pretty chin, "my little one is cold. Perhaps old St. Nick can fix the furnace."

"Could you, Santa?" Tommy Willard asked.

"Ho, ho," Gus cried out. "And why not? In my shop at the North Pole I fix many things."

Gus put Ann Trotter down and moved toward the basement door.

"I'll need tools," he said loudly, and his eyes sought out in the audience his helper at the garage, Stan Hicks.

GUS had fully expected that the parents and teachers would move to prevent the children from following him. Alone in the basement he could revert to Gus Wilson and work on the heating plant. But nobody made a move to prevent the shouting children from trooping along at Gus's heels.

Stan Hicks sidled out the door behind them. "I dunno what you folks are going to do," he said. "But me, I'm going after Gus's tools so Santa can do the job."

Sam Howard accompanied Gus into the basement. "I don't know anything about this gadget," he remarked sourly, "except how to turn it off and on."

Gus surveyed the ancient furnace with its gleaming conversion oil unit, feeling rising panic. On the way down he had glanced at the wall thermostat and noted that it was turned above the 70-degree mark. Yet the oil burner was silent and cold. Looking at the circle of youthful, eager faces about him, the awful realization came to him that every child in the basement was expecting Santa Claus to work wonders.

"Here, Santa," said one boy, offering his newly acquired present to Gus. "Use my tool kit—it's a dinger."

"Just the thing, just the thing, my lad," Gus boomed.

Gus located the fuse panel, inspected the fuses. He traced the copper fuel line from the burner to where it split into two lines leading through the cement wall to buried fuel tanks. Each line had its shutoff valve and individual sediment bowl. The right tank, Gus noted, was shut off, the valve on the left tank wide open.

"I brought your tools from your sleigh, Santa Claus," Stan Hicks kidded Gus as he approached with Gus's small emergency tool kit.

[*Continued on page 232*]

Prefab kits, quickly assembled, give you a choice of

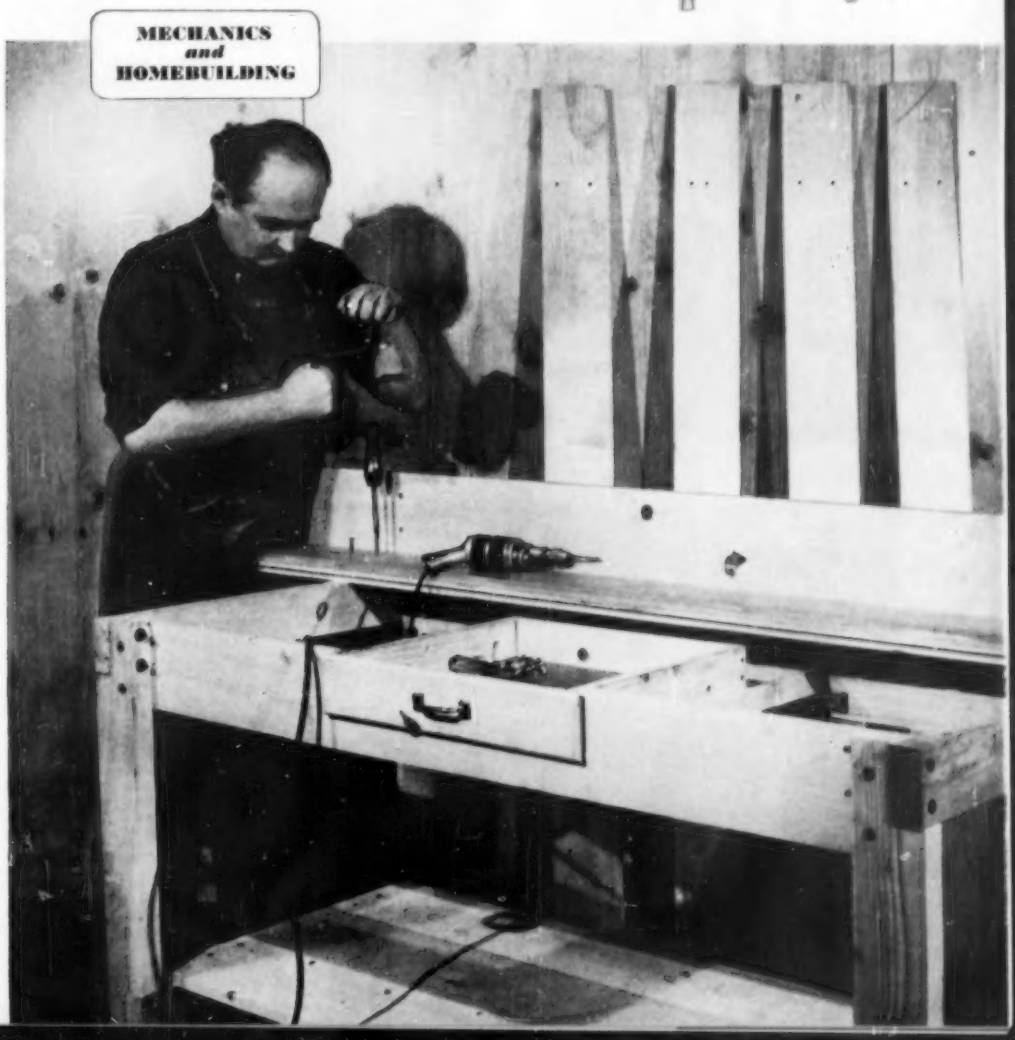
One-Evening Workbenches

By Kenneth Murray

WOULDN'T you like a fine new workbench for Christmas? Then here's a tip:

Just leave this magazine open to this page, where your wife is sure to see it. Maybe she'll take the hint and build you one.

Nobody's kidding. Like a lot of unfinished furniture, workbenches now come prefabbed—all the parts cut and fit-



ted for easy assembly. The little woman who has bolted together chests, dressers and kiddy furniture for the home is in good training for the job.

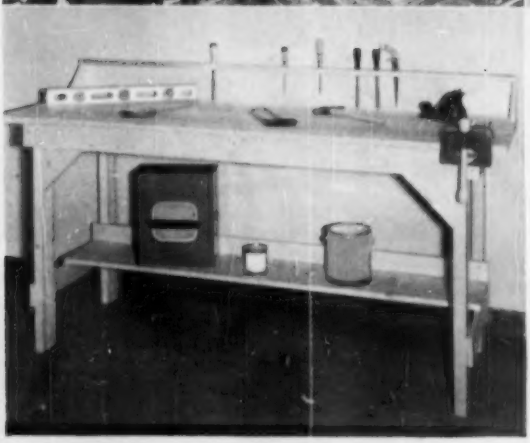
If she fails to take the hint, or if she's not the hammer-and-saw type, you may want to buy the kit yourself. Whatever you buy, you should be able to put it together in a single evening.

Four hours, twenty bucks. That's the story of the bench I ordered by mail. All pieces were cut to size. Dadoes, rabbets and joints were ready-made. Four hours from the time I picked up the instruction sheet, my bench was ready for use. Building it from scratch would have taken me three times as long. The kit cost me about $20, plus shipping charges.

You can pay more, or less, for a kit workbench.* (One manufacturer turned out a maple-topped model for the carriage trade at $150, but it never caught on.) Some are made entirely of wood, some entirely of metal and some are a combination.

Where to buy. Enterprising lumber

Types of benches that come in kits—and where to get them

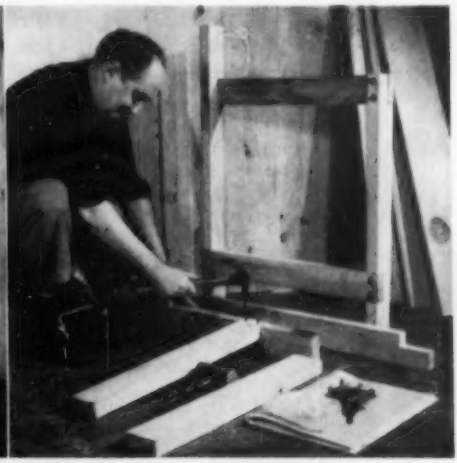


YOU CAN CHOOSE from these types. Benches built entirely of wood like the one at left still remain a favorite. But metal also is now widely used by commercial makers—sometimes for just the frame, with a wood top like the one at the upper left; sometimes for the top, too. The cabinet type above, usually made mostly of metal, offers lots of storage space.

**Workbench kits are produced by many makers, among them the following: Anchor Sales Corp., 350 37th St., Brooklyn, N.Y.; Belson Mfg. Co., N. Aurora, Ill.; Benchcraft, 3609 Olive St., St. Louis 8; Coast Lumber Co., 1041 Dixwell Ave., Hamden, Conn.; Frontier Mfg. Co., 10600 Hines Blvd., Dallas; Hallowell Division, Standard Press Steel Co., Jenkintown, Pa.; Harris Bros., 1349 W. 35th St., Chicago 9; Lumidor Mfg. Co., 4801 E. 50th St., Los Angeles 11; Lyon Metal Products, Aurora, Ill.; Mohawk Lumber Co., 14525 W. Chicago Blvd., Detroit 28; Montgomery Ward; Sears, Roebuck & Co.; Structo System, Elyria, Ohio; Sturdi-Bilt Steel Products, 2501 Peterson Ave., Chicago 45.*

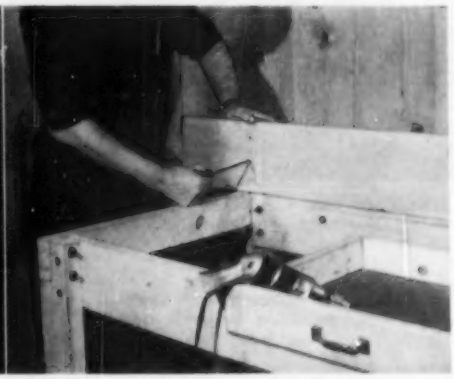
How one workbench goes together

PRECUT WOOD comes in a waterproof wrapper. Hardware is packed in the ready-made drawer.

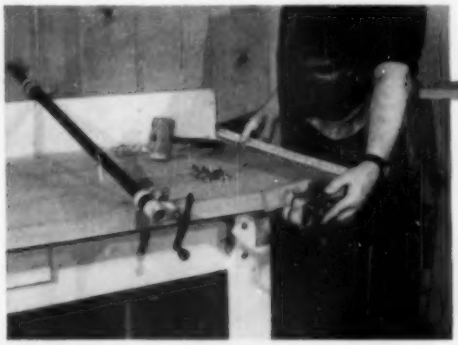


FIRST STEP is bolting together four pieces for each leg end. Bolts fit predrilled holes.

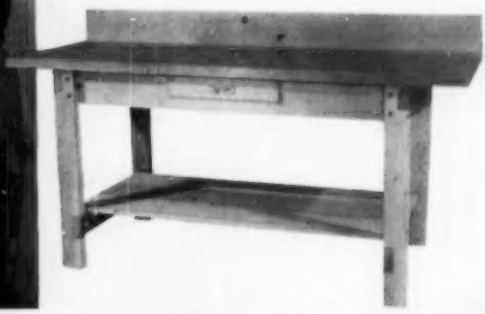
BENCH STANDS on its own legs when back rail is bolted on. Shelf boards are screwed on next.



FRONT RAIL and drawer guides go in next, and backboard is screwed to the top of rear legs.



FIVE PIECES of tongue-and-groove lumber make up the top. Clamps are useful but not vital.

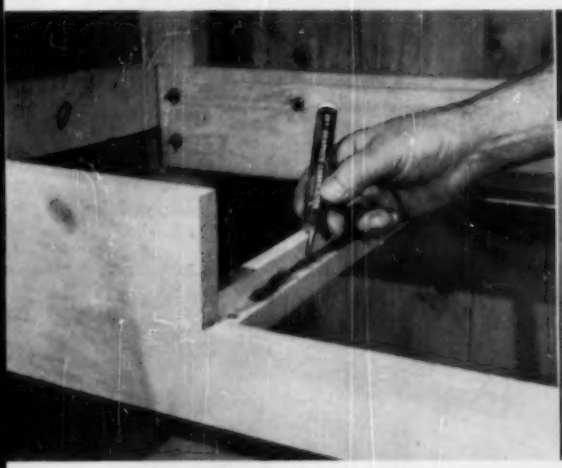


READY FOR WORK as it is, the bench could be fitted with extra shelves, or even enclosed.

yards assemble workbench kits of their own. These run all the way from just cut lumber to all-out prefab jobs. Other yards and stores may handle kits that are distributed on a regional basis only. You can also order by mail.

Any kit will cost you more than the raw stock. But your time is worth money, too, and a kit can save you shop time that you can put to better use on other jobs. Also, overestimating the amount of wood needed, or cutting one piece short, can cost you more than the difference. When you buy a kit, the figuring has all been done for you. All you have to do is put it together and enjoy it.

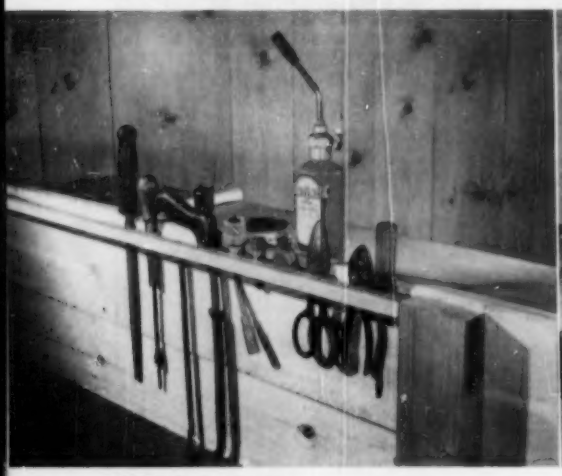
These simple dodges make a workbench even more useful



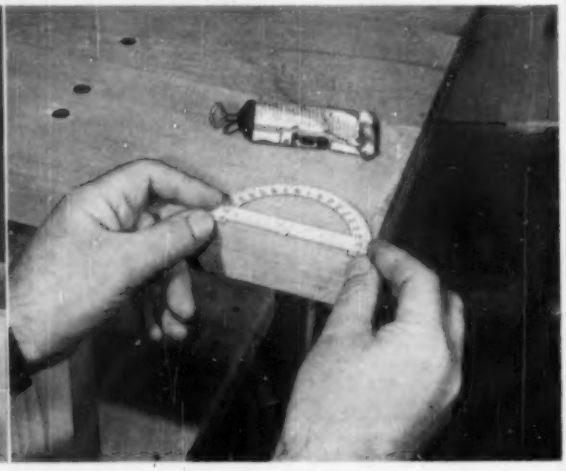
BENCH DRAWER will have roller-smooth action, even when heavily loaded, if dry graphite or grease stick is applied to the runner faces.

BEFORE GLUING, mask the working area of your bench top with waxed paper. A dispenser can be tacked to the workbench backboard like this.

BACK VIEW OF BENCH shows how a 1"-square wood strip toenailed between backboard uprights makes a tool hanger. The slot is 1" wide.



SMALL METAL PROTRACTOR, cemented to a corner of the bench top, enables you to check angles quickly, helps prevent building errors.

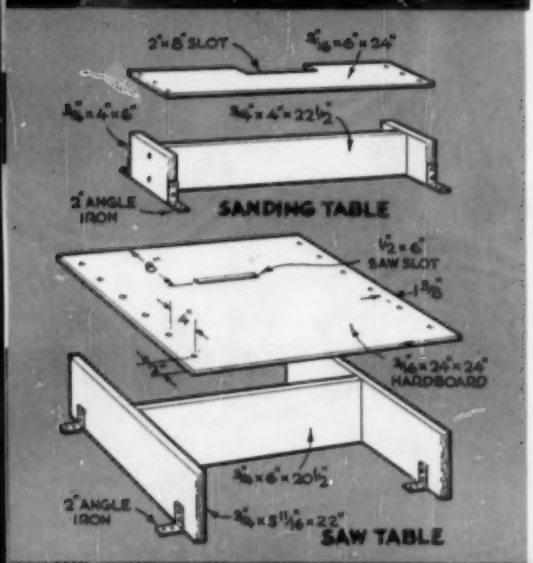


Clear off the tools and put your bench to recreation uses, too

WHEN a workshop adjoins a rumpus room, as it often does, consider the workbench as a sturdy piece of extra furniture.

It converts quickly into a buffet or bar. Add a rail or two and you have a shuffleboard or miniature bowling alley. Use it for vibrationless showing of movies or slides; it has room for accessory cases and a tape recorder besides the projector. And if you do darkroom work, there's no handier place to set up enlarger and developing trays. END

Drill Accessories You Can Make

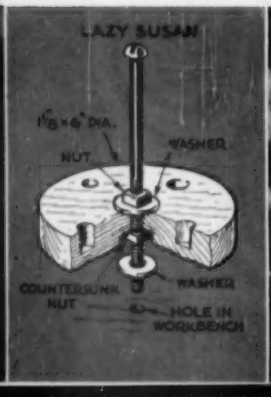


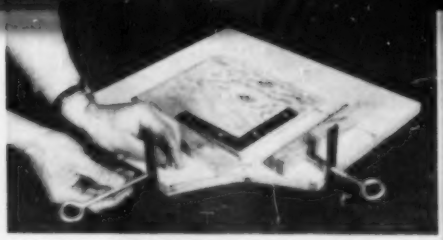
YOU take one big step toward getting the most from an electric drill by buying a horizontal stand. You can take another big step by building your own sanding and saw tables to go with the stand. The tables, as well as a handy Lazy Susan tool rack, might all be turned out in a single evening.

Sanding table. Fasten the drill stand to the workbench after blocking it up (if necessary) to place the drill-chuck center 5″ above the bench top. Make an H-shaped frame like the one shown at the upper left, using scrap wood. Screw on a hardboard top with a recess cut in one side for a 6″ sanding disk. Position the table so that the sanding-disk face is ¼″ from the parallel edge of the recess and anchor it down with angle irons.

Saw table. Here again, use an H frame to support a hardboard table top. Instead of a recess, this table has a slot for a 4″ saw blade. Make the table 5⅞″ high—this will give you a 1⅜″-deep cut with the same drill setup used for the sander. A slight table-top overhang lets you clamp on a pine strip for a rip fence.

Lazy Susan tool stand. Turned or sawed to 6″ diameter, a scrap of pine 1″ or more thick makes a handy revolving stand for electric-drill accessories. Drill holes for the tool shanks 1″ in from the edge of the disk and not quite through. At the center of the stand drill another hole for a long ¼″ bolt which serves as a pivot and handle. Countersink the bottom end of this hole so that the nut holding it in place on the bolt can be recessed almost flush with the stand. With a washer for a bearing, insert the end of the bolt in a hole in the work table.





CLAMP BRACKETS are 4" metal angles notched into underside of plywood so that base lies flat. Drill holes to take ¼"-by-4" eyebolts, and thread bolts into nuts that act as bearings.

TO EXPOSE JOINT for easy nailing, corner is cropped off on 5" radius from corner point. Eyebolts are tightened against wood blocks that are faced with sandpaper strips to prevent shifting.

Wooden Jig Clamps Miter Joints

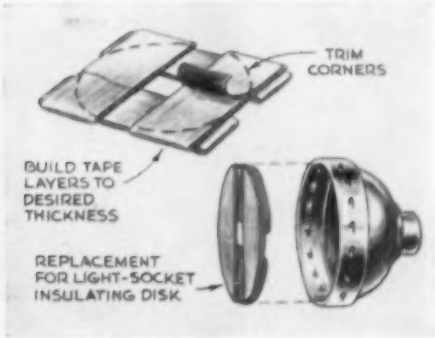
You need four hands to assemble picture frames or other mitered joints. This homemade clamping rig will do the job of two of them for you.

I used a 16"-square scrap of plywood for the base and screwed a smaller square on top, about 4" in from each forward edge, to serve as a right-angle stop block. A flat angle plate screwed to the front corner of the stop block prevents wear and insures a 90° angle.

Two eyebolts, acting as screw jacks, force the mitered pieces firmly against the stop block so that you can glue and nail them together without their shifting. If the bearing nuts turn with the eyebolts, wedgelock them with metal shims underneath. The jig can also clamp butt and other joints and join different widths of wood.—*Paul Corey, Sonoma, Calif.*

Square Hangs on Split Block

A wood block, grooved along the top edge, makes a snug tool-board holder for hanging up a large, awkward framing square. Fasten the block, in this case to perforated board, with wood screws from the back.—*Frank A. Javor, N. Bergen, N. J.*



Tape Forms Insulating Washers

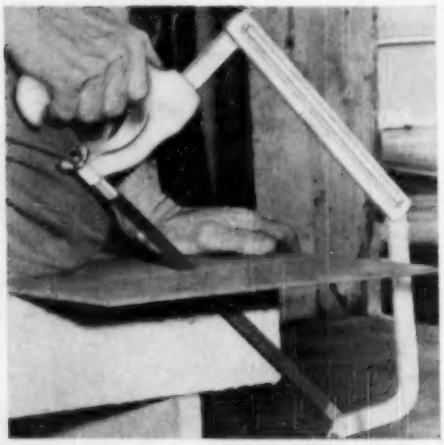
Nonconductive washers and spacers can be made to almost any size, shape and thickness from electrician's tape. Square off strips around a center hole, add layers for desired thickness, and trim the washer to shape.—*Charles H. Hardy, Los Angeles.*

New Tools

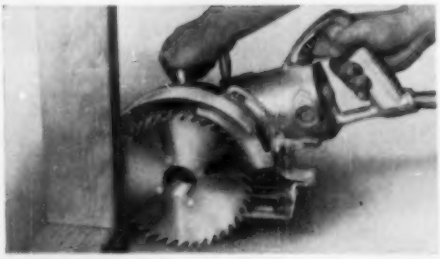
1. Seesaw Arbor Changes Tools. You can change over from sawing to planing in a trice on this husky tool. The trick: a single-wheel arbor control that simultaneously raises the 8″ tilting-arbor saw blade and lowers the 4″ jointer head, or vice versa. The 10″ tilting sanding disk at the side can be removed and a flexible shaft, for auxiliary tools, attached in its place.

2. Wrench Handle Bends into Corners. This flexible wrench gets into tight places crowded with pipes. A ratchet handle lets you set the jaws firmly around the work for a good pulling position. Interchangeable jaws can be fitted on the Handi-Flex pipe wrench by removing a pin that separates the head from the handle.

4. Hammer Head Changes Faces. One hammer can do many jobs when you snap different faces—aluminum, brass, copper, nylon or plastic—into its head. A countersunk spring pin locks them in. Heads come in aluminum for light work, or steel for heavy; handles are non-slip or smooth finish.

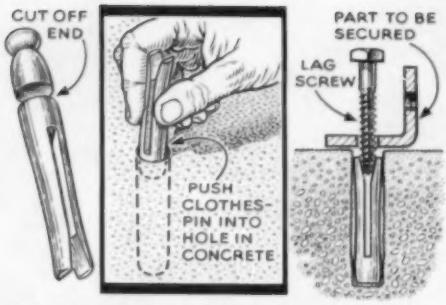


3. Hacksaw Expands for Long Cuts. When you pull up on the back brace, this hacksaw expands to a 7″ height for making deep cuts in anything from thin metal to large-diameter pipes. Called the Hi-Lo, the new saw also features a knuckle guard on the aluminum pistol-grip handle.



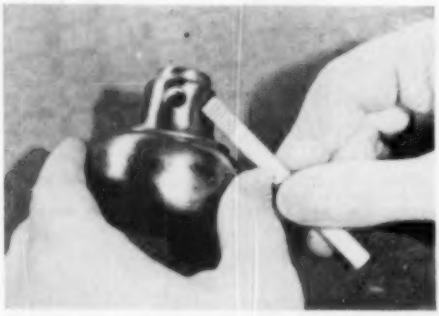
5. Electric Handsaw Cuts Flush. First of a series of blades for flush-cutting with an electric handsaw, this blade adapts the No. 77 Skil Saw for such cutting of studs, beams, floor joists, rafters, door plates, windows, door framing and other jobs. The manufacturer plans to make these blades for all electric handsaws. The new blade is 7¼″ in diameter with a riveted hub for mounting. An aluminum guard screws on.

Further information on these tools can be obtained from: 1. Yates-American Machine Co., 701 Fourth St., Beloit, Wis.; 2. Todd Products Co., P.O. Box 1621, Rockford, Ill.; 3. Mansfield-Zesiger Mfg. Co., P.O. Box 212, Cuyahoga Falls, Ohio; 4. Hi-Lok Mfg. Co., 1625 Massillon Rd., Akron, Ohio; 5. Barnes Blade Co., 16249 Colorado Ave., Paramount, Calif.



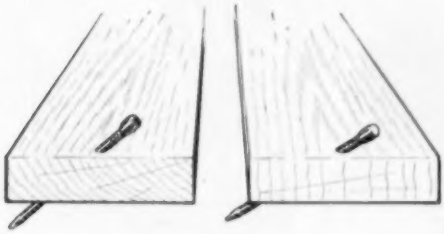
Clothespin Holds Lag Screw

NEED a good expansion shield for holding a lag screw in concrete? Saw the head off a wood clothespin and drop the pin, ends up, into a hole drilled in the concrete. —*Stanley Clark, East Bradenton, Fla.*



Dowel Takes Setscrew Thread

TWISTING a dowel in the setscrew hole of a doorknob cuts matching threads in it and will save you the trouble of lugging the doorknob down to the hardware store if you have to buy another setscrew.

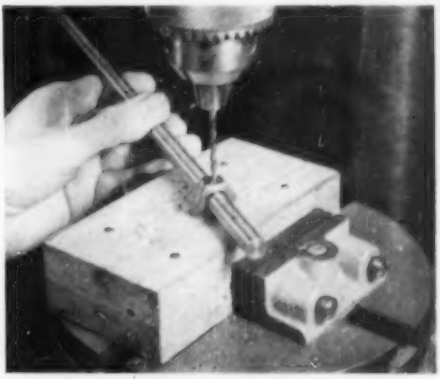


How to Prevent Splitting

TO AVOID splits when you nail near the end of a board, drive the nail at right angles to the grain, or as nearly so as possible. The above examples show how to do it right.—*W.A. Isphording, Gainesville, Fla.*

Car Jack Opens Stuck Windows

I TIRED of yanking or hammering windows in my house every time they stuck. So I now use my car jack to open them. Hold the top of the shaft to keep it from hitting the glass.—*R.L. Hay, Rochester, N.Y.*



Nut Helps Drill Round Stock

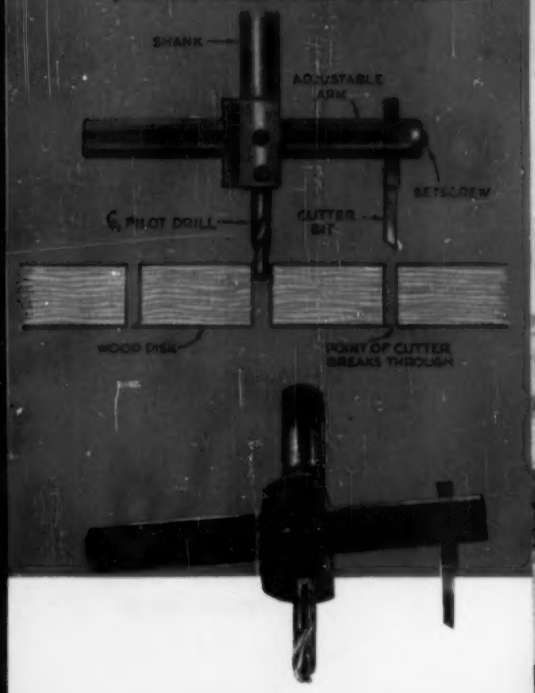
A LARGE hex nut can be converted into a drill jig for centering radial holes in rods or tubes. Ream out the nut if necessary to make it slide freely on the stock. Then drill a guide hole so that it passes through the center of the nut opening. You'll find a collection of these drilled nuts, in various sizes, handy to keep around the shop.

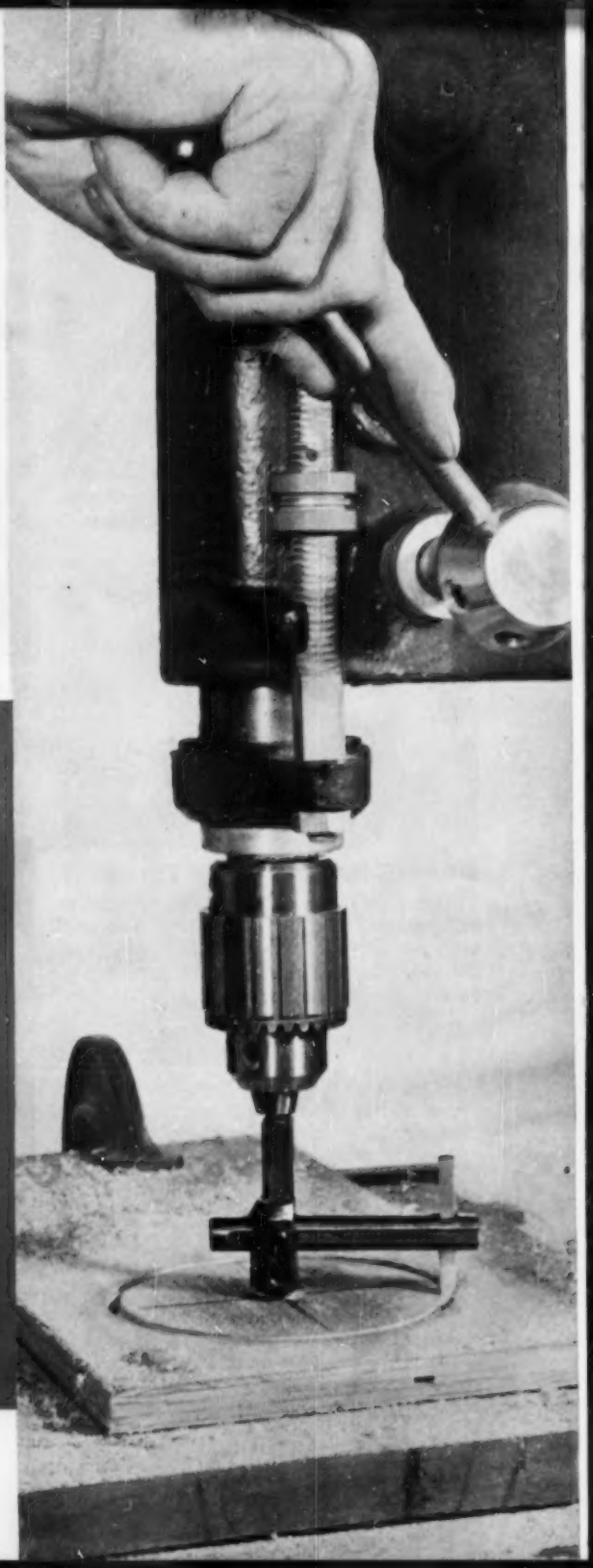
Have you been missing something good? There's a long list of

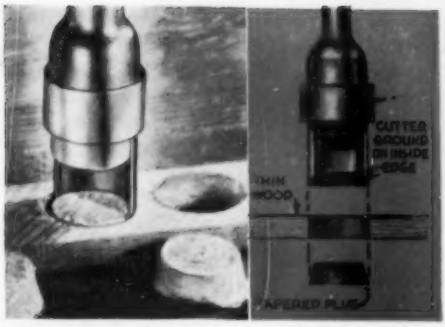
Special Boring Bits You Should Know About

By Edwin M. Love

CIRCLE CUTTER. Want to make a really big hole? Need wood wheels for a toy that you are making? This tool produces holes or disks as big as 8" in diameter in wood up to about 1½" thick. Circle cutters come in several sizes. They work best in a drill press and should be run at low speed.







PLUG CUTTER. Out of thin wood, it cuts tapered plugs to cover deep-set screws. If the grain is very carefully matched, these plugs are almost invisible even under a natural finish.

SCREW-HOLE BIT. A real time saver, this one does three jobs at once: bores a pilot hole for screw threads, reams out the part the shank will occupy and counterbores for the screw head. The button stops the bit at just the right depth to sink the screw head flush. Bits come in sizes to match the screws you commonly use.

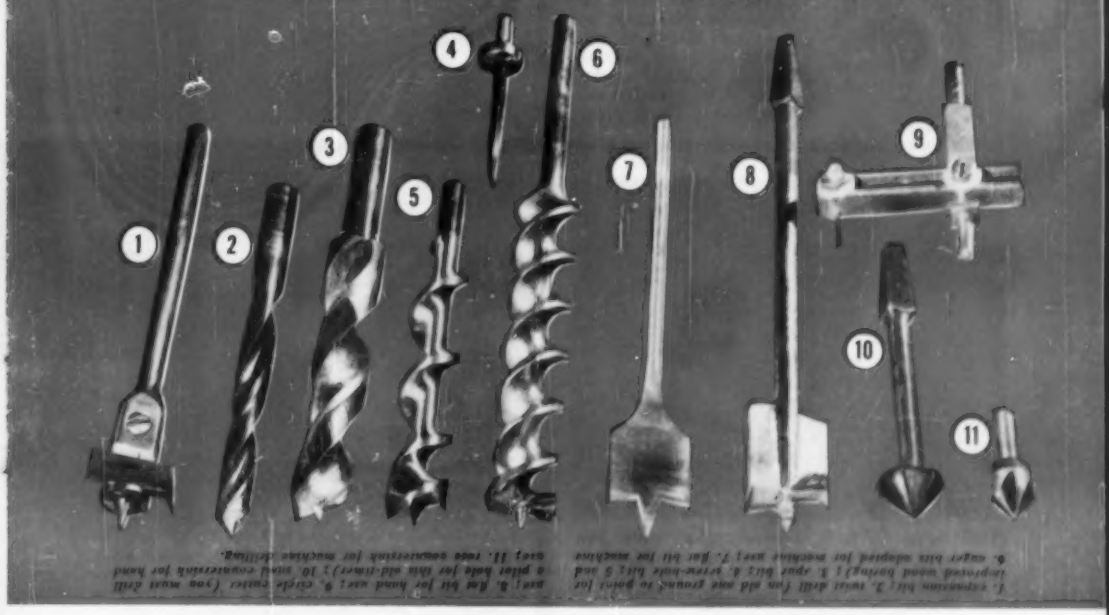
SUPPOSE you had a gross of screws to sink. How could you do the job the quickest way?

Any way you go about it, making holes for, and driving in, 144 screws would be a mighty tiresome job—even in softwood.

And in hardwood you certainly couldn't get by with just any old hole, expecting a screw to make its own way. For hardwood, the approved procedure includes drilling a primary hole the same size as the screw shank, a smaller deeper one into which the threads can twist, and countersinking for the screw head.

One tool does it. All three operations can now be done simultaneously with a single tool—a screw-hole bit chucked in

CAN YOU IDENTIFY these 11 hole-making tools from Edwin M. Love's shop? Several have been altered for special work. Turn the page upside down for the names of ones you don't know.



1. expansion bit; 2. twist drill (you all are grunts to point for improved wood boring); 3. spur bit; 4. screw-hole bit; 5 and 6. auger bits adapted for machine use; 7. flat bit for machine use; 8. flat bit for hand use; 9. circle cutter (you must drill a pilot hole for this old-timer); 10. hand countersink for hand use; 11. rose countersink for machine drilling.

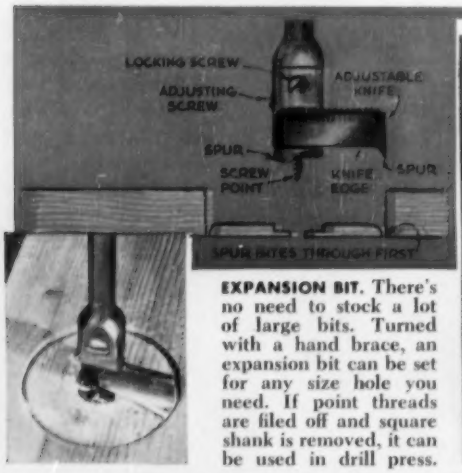
the hand drill, electric drill or drill press. Sink it to the stop and you're ready to drive the screw.

That's only one of several special hole tools the home mechanic should know about. Here's a round-up of others.

An expansion bit can do the work of several auger bits, and make between-size holes for which you cannot buy bits. It has a single adjustable knife and a screw pilot. Always clamp the knife securely before boring. The markings give approximate hole sizes, but for critical work, make some trial cuts in scrap to set the bit.

A circle cutter has the bit mounted on the end of an adjustable arm. To minimize break-through splintering with this or an expansion bit, either clamp a backing block behind the work or, better, bore only until the pilot breaks through, and then turn the work over, insert the pilot and finish the boring from the other side.

With any tool that cuts on one side only, run the drill press at low speed and clamp the work securely. When using such bits in an electric drill, keep a quick trigger finger on the switch. Never hold the work by hand.

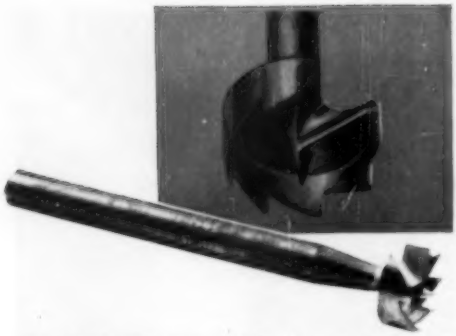


EXPANSION BIT. There's no need to stock a lot of large bits. Turned with a hand brace, an expansion bit can be set for any size hole you need. If point threads are filed off and square shank is removed, it can be used in drill press.

FOERSTNER BIT. Two cutting lips and a circular knife edge shear smoothly through wood fibers. Since the bit has no center point, it produces flat bottoms in holes that are not bored right through the work. Clamp wood in a drill press and you can cut any part of a circle from its edge. These bits are also made with square shanks for chucking in hand braces.

PUSH DRILL. This is a handy tool when you have only one hand free to bore a hole. Here screw holes are quickly drilled while a hinge is held in place as a guide. Several straight-flute bits come with such a drill.

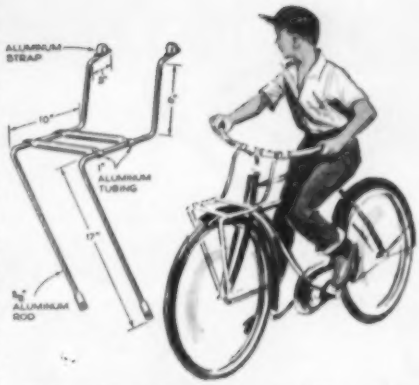
HOLE SAW. A circular saw blade cuts a neat round hole in wood or metal, and a compression spring knocks out the plug. A hole saw is a perfect tool for cutting thin plywood.



MULTIPLE-SPUR BIT. With its many cutting edges, this works fast and will make scads of truly round holes before it needs resharpening. Sizes range from ½" up to 2".

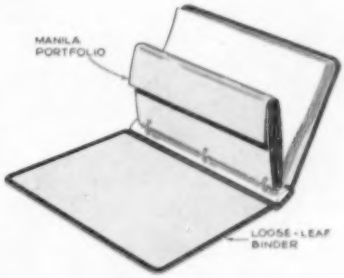
EXTENSION. Install an extension between a hand brace and auger bit like this and you're all set to bore into deep recesses or to make overhead holes without standing on a ladder. The extension will follow the bit into an 11/16" hole. This makes a fine combination for boring wiring holes in lamp columns of wood.

DOWELING JIG. This puts edge holes exactly where you want them. Clamp it on the board with its centerline over the penciled guide line. Then center and lock a bushing of the required size in position. Once set, it will locate a dowel hole in a second board so that both holes are aligned. A bit gauge, seen at the lower left, is clamped to a bit to stop it when the hole has reached the desired depth. END



Bike Rack Made in an Evening

THIS sturdy bike rack is just the thing for Junior to carry schoolbooks or packages on. Bend two 36" lengths of ⅜" aluminum rod to the shape shown above and fit them to the bicycle by trial. The cross-pieces are 9" lengths of 1" aluminum tubing with the ends flattened and secured with self-tapping screws. Fasten the frame to the handle bars with aluminum straps over protective strips of rubber.—*Charles Lomas, Kensington, Md.*

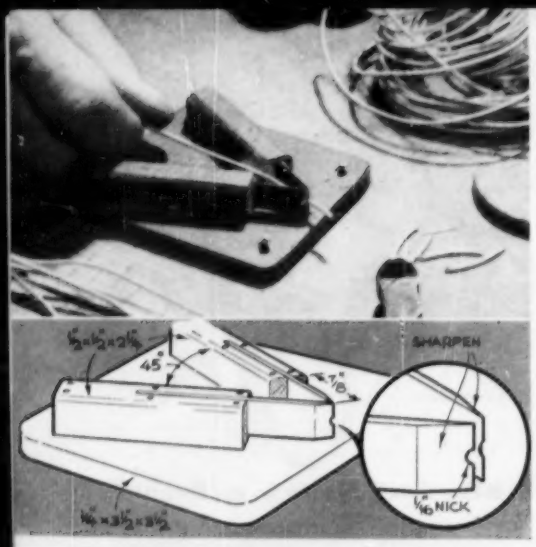


Folder Makes School Kit

A HANDY pencil kit for a school child can be made by mounting a small Manila portfolio in a loose-leaf book. Punch holes for the rings and reinforce with gummed circles.—*Frank Shore, NYC.*

Pencil Lead Lubricates Lock

LOOSEN up a sluggish lock by pouring powdered lead from a soft pencil into the working parts when graphite isn't handy. Powder the lead by rubbing it on sandpaper or a file and collect it on a sheet of paper.—*R. W. De Cesare, Vallejo, Calif.*



Two Wire Strippers That Give You the Pro Touch

If you aren't adept at stripping electrical wires with a knife, you may find it helpful to have one or both of these homemade strippers on hand.

The triangular job above cuts and strips the insulation as you pull the wire back, after inserting it between the knives by a forward motion. The forward motion also seats and locks the wire in the mating nicks in the stripping blades.

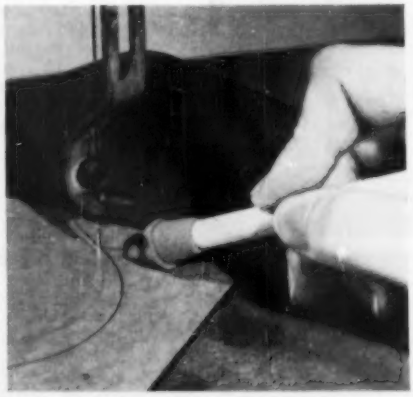
To make it, grind about ⅜" of teeth from each of two 2½" lengths of hacksaw blade. Sharpen the ends of the blades, as shown, and press the blades into saw kerfs made in the diagonal members.

The screwdriver attachment below cuts through the insulation as you rotate the wire in the knife slot. When you tug the wire the insulation stays behind.

This stripper is a piece of spring steel with a triangular notch filed in one edge. The edges of the notch were then ground to knife sharpness on the side adjoining the screwdriver shank to which it is welded.

Polished Bits Turn Easier

Auger bits discharge shavings better and heat less if you keep them polished. Rub a wad of steel wool along the flutes occasionally. It's also a good idea to wipe the bit with an oily cloth after each use.—*Edwin M. Love, Palmdale, Calif.*



Stick Guides Jigsaw Work

You can guide work into a jigsaw blade with a push stick made by slipping a pencil eraser on a piece of ¼" dowel. This will keep your fingers away from the blade.

Chalk Clogproofs File Teeth

To file brass, aluminum or other soft metals with an ordinary file, rub chalk liberally into the teeth. The chalk will keep the metal from clogging up the teeth.—*Lew Williams, Columbus, Ohio.*

Extension Reel Puts Light on Job

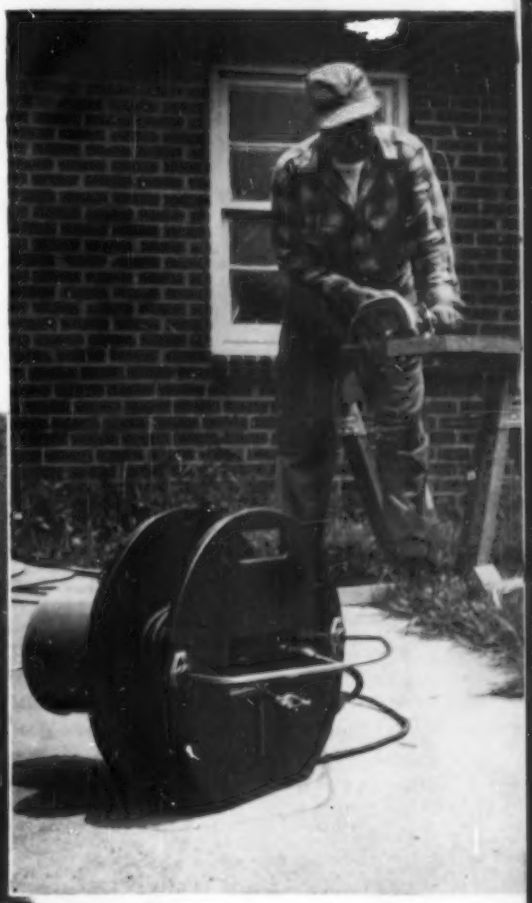
By R. G. Cooper

AFTER unrolling enough extension cord from this multi-purpose reel to bring power to the job site, you can plug in one or several portable power tools and connect their ground wires to a ground terminal for safe operation. Then as dusk approaches, or if you work into a dark corner, you can turn on a built-in light and aim it where you need it.

To ground the tools, the extension should be No. 16 three-wire line cord, and the plug should have a pigtail for attaching to the primary outlet box.

Make the reel hub first; its shape is determined by the receptacle and light socket used. Those shown are identical in size. The tool-lead receptacle is a two-outlet, 15-amp. Bakelite type, 5″ long by 1¾″ wide. The lamp socket is a surface type with a pull chain. Fasten them back to back on a ½″-plywood divider. Then build the four sides of the hub around them, grooving one side to clear the pull chain. Round all corners so that they won't dig into the wire.

Cut two 13½″ disks of ½″ plywood for reel ends, brad them together lightly and



NIGHT AND DAY, this extension-cord reel is an often-needed job accessory. By night or in dark corners (left) it throws light where you want it; by day (above) it carries power to outside work.

cut a 6½" flat edge on both at the same time. In one disk cut a handle and a rectangular opening to match the receptacle. Add a dime-store towel bar, bent as shown. It will serve as an angle support on the ground or as a hanger for overhead lighting. Cut a hole in the center of the other disk to fit the socket.

TO GROUND a tool for safe use, clip an alligator clamp to the tool's ground lead. The clamp is soldered to the third wire of the cord.

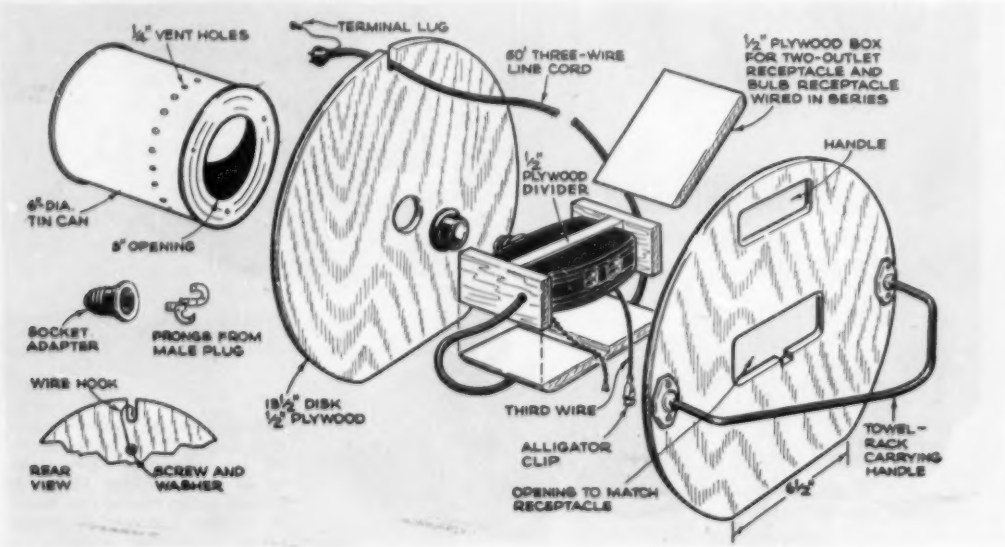
Fasten the first disk to the hub with 1" wood screws. Screw the shade-holder ring on the socket to secure the other; then line up the two flats and screw the second disk to the hub. Cut a reflector from a 6"-diameter tin can, leaving a flange on the bottom so that it can be screwed on over the socket.

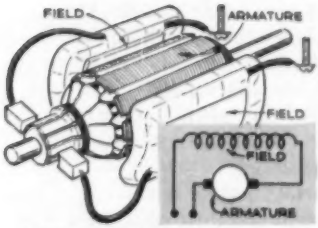
Connect two wires of the three-wire cord to the receptacle in the reel. Bring the third wire out and attach an alligator clip to its end. At the plug end of the cord, hook up two of the wires to a two-prong plug and pull the third wire (usually the green one) out through its neck. Solder a terminal lug to its end. When using power tools, snap the alligator clip on the tool's ground lead and fasten the terminal lug to the metal case of the outlet you plug into, using one of the screws that hold the cover plate on.

Screw two prongs from an old plug to the reel for storing a socket adapter; you'll need it if you have to plug into a garage or porch light.

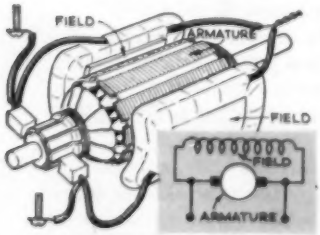
Bend a hook from coat-hanger wire and fasten it near the cord slot to anchor the plug when the cord is reeled in.

Wind 50 to 100 feet of cord on the reel and you've got power all over the lot.





CALLED UNIVERSAL because they run on AC or DC, these motors are of two types. Most common is the series motor above. Its field and armature are in series, often with the brushes between the two field coils. It develops a high starting torque.



SHUNT MOTOR has field windings and brushes connected in parallel. It runs at a constant speed either free or loaded, but does not have a high starting torque. If a series motor is reconnected in shunt, it must be operated at lower voltage.

First Aid for Universal Motors

How to service those little power plants that drive many home and shop appliances.

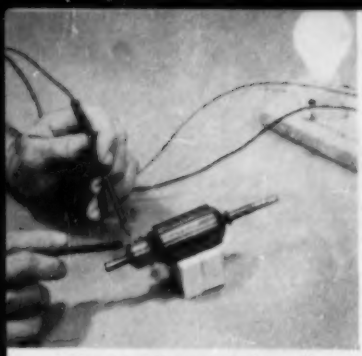
By J. W. Rocke Jr.

I LEARNED about universal motors by mistake—one that I had made overhauling the dust collector on my bench sander. It caught up with me one night when Cam Evans was at work in my shop.

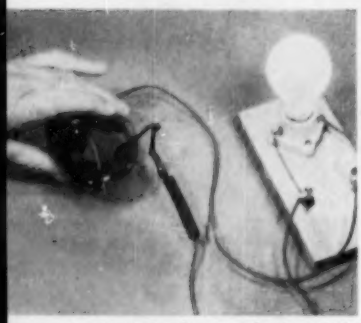
Cam was sanding some shelf brackets. Suddenly a shriek drowned out the whir of the sanding belt. The motor of the dust collector revved up to a whine before he could snap it off.

"Just yank the plug and finish sanding without it," I suggested. "That thing hasn't worked right since I put in new brushes."

Cam, the manager of our local power plant, is a neighbor of mine. He comes to my place when he has any woodworking to do, for his own shop is rigged

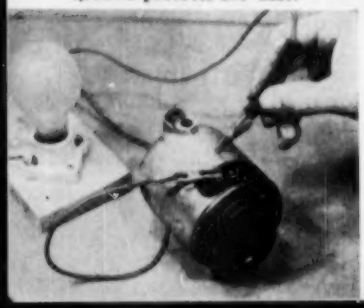


SERIES TEST LAMP is a 40-watt bulb. Hook one socket terminal to line, the second to one test prod or clip. Run other side of line to second prod. Hold one prod on a commutator bar and touch each of the other bars with the second prod. If lamp fails to glow, there is an open circuit in the winding connected to that bar. If lamp glows when second prod is held on the shaft, winding is grounded.



NAIL TEST shows whether field polarity is correct. Join two ends of field coils and touch test prods to the other leads. If a nail refuses to stand inside field core, the poles are alike and motor will not run. Interchange leads of one coil. Nail stands upright as shown when the polarity is correct.

CHECK FOR GROUNDS with one prod on terminal (or both if motor has a switch) and other on the case. Lamp should not glow. An internal ground may not keep motor from running, but is a shock hazard. An extra wire from case to an outside ground protects the user.



strictly for a busman's hobby—in his case, electricity.

"Tomorrow's Saturday," he said as he was leaving. "Bring that motor around and we'll fix it."

The backward drill. When I entered his basement shop next day I found Cam and Bud Nolan bending over a hot workbench. Hot electrically, I mean. Cam's main bench is loaded with meters, switches and pilot lights.

Bud is a bright teen-ager who's headed for an engineering degree. He's often at Cam's place.

"It sparks like anything," he was saying, and snapped on an electric drill lying on the bench. Even from where I stood, I could see fireworks inside.

"The commutator's smooth," he added, shutting it off. "What should I do? I know—new brushes!"

Cam shook his head, and Bud looked puzzled again.

"One thing I'd do—" I began, and stopped.

"Hello, Jack," Cam said to me. "What were you saying?"

"Oh—only that Bud better reverse the motor. You couldn't drill with the chuck running backward."

Bud went pink. "Brush leads were frayed, so I put on new ones—and hooked 'em up wrong! Thanks. Wish you could tell me how to stop that sparking, too."

"He has," said Cam. "You know what happens when a motor runs backward for its brush setting."

"That's it! It'll spark. And brushes always wear a bit lopsided, so they stub their toes when the motor runs the other way, and spark even more."

Elated, Bud took the drill to another bench.

Runaway motor. I laid down the dust collector I'd brought. When Cam unbuttoned the motor, the suction fan fell out. It took no Edison to guess what had made that shriek—the blades showed scratches where they'd scraped the housing. From the fan hub Cam removed a mangled setscrew. He grinned as he saw it.

"Wrong-size screwdriver," I mumbled. "Chewed up the slot so I couldn't tighten it right."

"Uh-huh. I'll check the motor now."

Sliding out the armature, Cam stepped around the commutator segments with two prods. A bulb blinked each time, except in two spots.

"Open circuit there," he said, pointing to a couple of loose wires with one prod.

"I didn't notice those before."

"No, they were thrown out by centrifugal force when the fan came off. A universal series motor has no speed limit—it'll run wild without a fan, gears or other load to hold it down."

Deftly he soldered the leads back in their slots. Then he ran a thumbnail over the copper bars.

"I undercut the mica with a hacksaw blade like you always do," I said hastily.

"Uh-huh. But you ground the blade too narrow. It sawed slits in the mica, leaving high sides. See how heat expansion has shoved the uncut sides up?"

Deflated, I could only nod.

"The mica should be undercut clear across between bars, as deep as its width. I'll show you."

In his lathe, Cam skimmed off just enough copper to leave the commutator smooth. After undercutting it with a broken hacksaw blade, he laid the armature on what looked like an electromagnet.

"This is a growler," he said, and sure enough it growled as he switched it on. Rotating the armature slowly, he held the hacksaw blade over its core.

"The AC magnetic field induces a potential in the armature windings," he explained. "If one is short-circuited, a current would flow and magnetize the core, attracting the blade. But it's okay."

Seating the brushes. Shutting off the growler, Cam frowned over the new brushes I'd put in. "See that shiny line on the end," he said, holding one up. "That's how much was riding the commutator."

"But don't they have to wear in?" I asked.

Cam shook his head. "It's better to seat 'em."

Cutting a strip of fine sandpaper, he taped it around the commutator and slid the armature into the housing. "Now we put the brushes in and turn the shaft," he said, and did so. As he was taking the armature out again, Bud coughed behind us.

"Drill work all right?" Cam asked him.

"Yeah. I haven't used it, but it runs real cool on the bench. I—uh—got another job."

Rather sheepishly he laid down some motor parts.

"Looks like an old hair dryer," I said.

"It's Margie Benson's," Bud confessed. "It was so gummed up that the shaft hardly turned. I even took out the field windings to clean it. Now it won't run."

"Did you make the nail test, Bud?" asked Cam.

"No, guess not. What's that?"

"A test for field polarity, good for universal motors or little shaded-pole AC motors like this one. Touch the test prods to the field-coil leads."

As Bud did so, Cam placed a small nail between the field poles. It fell over, buzzing.

"You hooked one coil up backward," said Cam.

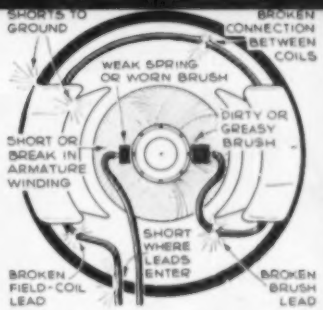
Startled, Bud looked closely at the leads. "I guess I did—yeah, this one!"

"Switch it around and see what happens."

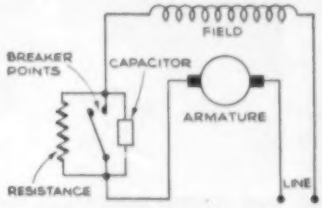
Balance of power. Bud changed around the two coil leads, and after Cam had stood the nail between the poles again, applied the prods. The nail stayed upright.

"Why didn't it do that before?" I asked.

"Both poles were the same polarity," said Cam, "so the top one repelled instead of attracting the nail. The

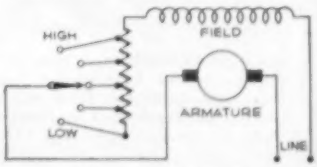


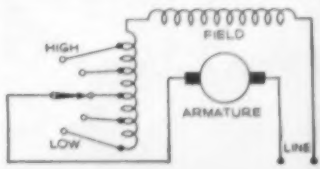
TROUBLE SPOTS. If lamp test shows an internal ground, check points shown above. Inspect all leads for frayed spots. If test lamp does not light with prods on motor terminals (with switch on), check points indicated above for open circuit.

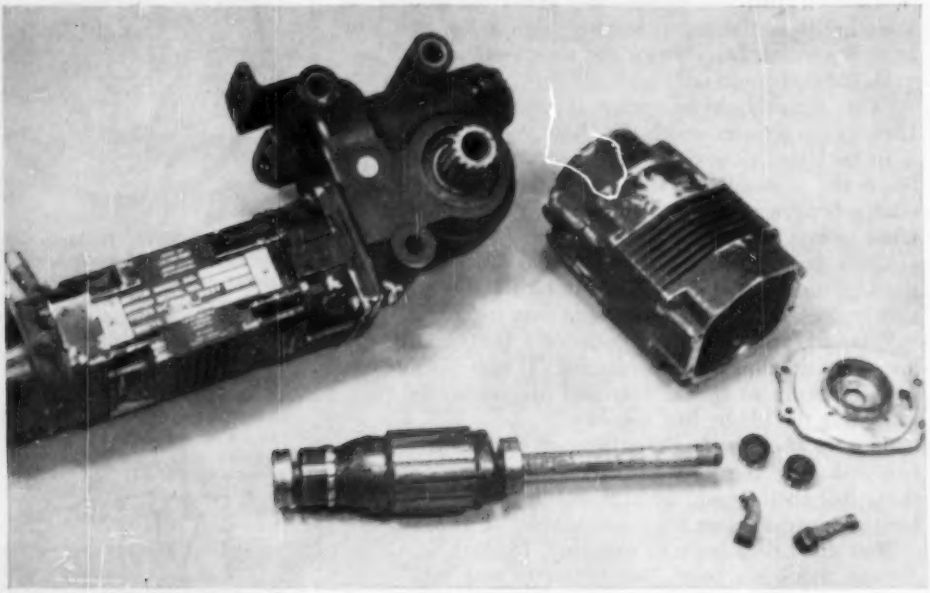


CENTRIFUGAL SPEED CONTROLS on kitchen mixers afford up to 16 speeds. As revs go up, centrifugal switch opens, and current can flow only through the resistance. This slows down the motor until points close and speed it up again. Cycle is so rapid that speed stays constant. Control knob alters spring tension on the points, making them open at higher or lower speed. Capacitor reduces arcing.

TWO OTHER METHODS of speed control: One, directly below, uses a tapped resistance. The control switch cuts all or part of it into the circuit, or for high speed cuts it out altogether. Tapped-field method at bottom has taps at various points of one field coil, usually wound in sections with different wire sizes. Switch cuts in more or less of this coil, which is connected to buck rather than reinforce the main field.







WAR-SURPLUS MOTORS like this are of top quality, and often a good buy. Permanent-magnet type should be run on DC only. Wound-field motors like that above work on AC or DC and can be altered to shunt connection for use on about half rated voltage. Some have limit switches that stop the motor after the output shaft has traveled a certain distance, but still allow the motor to be reversed.

DRY BEARINGS can sap the power of the best motor, but lubricate sparingly. Over-oiling may foul brushes. The handle must be opened to oil this drill.

field poles in a motor must be of opposite polarity."

"Thanks a lot," said Bud. "Now I'll use my drill to mount those shelf brackets for you."

He tore off. Cam wrapped cord over the commutator leads of my armature "to keep them from flying off the handle again," as he put it. He was shellacking the cord when a sort of Comanche war whoop rang out.

We swung around in time to see Bud save his drill from crashing to the floor only by a wild grab at the cord. It was still running. Instead of switching it off, he yanked out the plug.

Groundless claim. "Whew! My hand's still buzzing," Bud said as he brought the drill over. "This ground wire you said should prevent shocks—it sure didn't."

"Sure you had it grounded?" asked Cam.

"Yes, *sir*."

"You mean that short extra wire near the plug?" I asked. "What's that for? My drill has none."

"Yours is an older model," said Cam. "It's a safety measure. You can add it to yours."

"What for? It runs fine."

"To save yourself a shock if your motor should develop an internal ground. That's what you have if insulation fails, a winding touches a core, or a lead or brush holder makes contact with the case."

"Wouldn't that keep the motor from running?"

"Not necessarily. But if the drill touches a radiator, water pipe or other earth ground, it might blow a fuse.

TROUBLE-SHOOTING CHART
(Universal Motors)

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Motor lacks power	Dry bearings	Lubricate sparingly.
	Searings binding	Realign end plates.
	Armature dragging against field poles	Install new bearings.
	Oily commutator	Clean commutator and brushes with carbon tetrachloride.
	Worn brushes or weak brush springs	Replace brushes, springs or both.
	Defective speed control	Clean and check.
Motor overheats	Dry or binding bearings, dragging armature	Lubricate, realign or replace bearings.
	Internal short in field coils	Check with ohmmeter. Rewind if necessary.
	Internal short in armature winding	Check on growler. Rewind if necessary.
	Low voltage	Check line voltage, motor cords and connections.
	Vents clogged	Blow out dirt. Dismantle motor if necessary.
Excessive sparking at brushes	Rough commutator	Turn smooth on lathe and undercut mica.
	Carbon on commutator	Polish with fine sandpaper.
	Poor brush seating	Reseat brushes.
	Weak brush springs (may be due to overheating)	Replace springs, check operating temperature.
	High mica	Undercut commutator.
	Wrong rotation for brush setting	Reverse motor or shift brushes.
	Brush setting altered (in case of movable brush assemblies)	Shift brushes until sparking ceases.
	Opened or shorted armature winding	Check on growler, repair as necessary.
Motor dead at some armature positions	Open circuit in armature winding (motor will also lack power and spark excessively)	Check and repair as necessary.
	High mica at one or more points	True and undercut commutator.
	Sticking brushes	Clean with carbon tetrachloride.

One side of your power line is grounded at the meter, so the current could hop off at the internal ground inside the drill, and go back through the pipe to the meter."

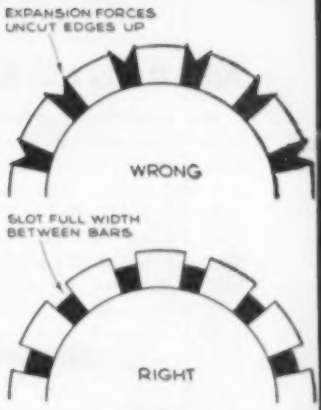
No internal ground. Bud had laid the drill on the bench. Now he held one test prod on both plug prongs, and the other to the drill housing. The lamp did not light.

"Look," he said. "There's no internal ground."

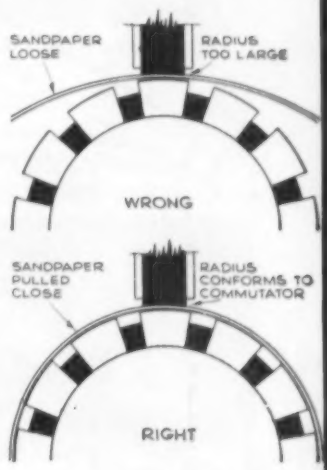
"Hold it," I asked. "I still don't see what good that third wire does."

Cam grinned. "Suppose your drill, with an internal ground, didn't touch a pipe or radiator, but *you* did. The current would go through you. If you were standing on a wet basement floor, or on damp ground, you wouldn't even have to touch anything. But with the

[*Continued on page 234*]



UNDERCUTTING INSULATION



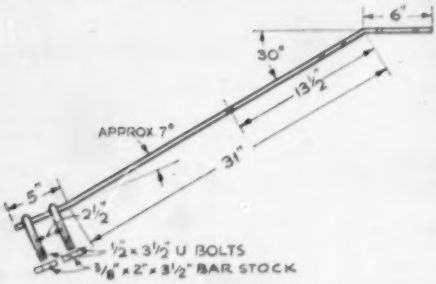
SEATING BRUSHES

TO RECONDITION a commutator, mount it between centers or in collets in lathe. Turn smooth and parallel, removing as little metal as possible. Clamp armature in vise with wooden pads, as below. Cord wrapped around commutator leads keeps them from pulling out at high speed. Grind hacksaw teeth same width as mica for undercutting. Seat brushes as shown above. When disassembling a motor, note position of brushes. If commutator does not need servicing and brushes are not worn too short, they can be re-used. Insert them in original position.

Auto Parts Put Spring in Toy Bronco When Rider Hops On

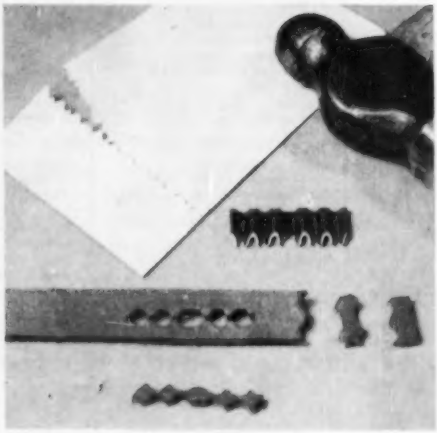
My youngsters envied their neighbor's hobby horse so much that I decided to make them one that was better. Auto-spring leaves put real bounce into the footing. For the seat mounting I had a 42" length of ⅜"-by-2" bar stock bent and drilled to take bolts for securing the horse's head, seat and footrest, all jigsawed out of plywood.

A wooden block holds the metal pieces apart, and two U bolts secure the sandwich. *—M/Sgt. R. Seidel, Fort Leavenworth, Kan.*



Tape De-lints Jewel Boxes

Remove lint from the velvet lining of a jewel box by inserting a loop of cellulose tape, sticky side out, in a clothespin and dabbing it on the velvet as shown above.



Fastener Cuts Fancy Designs

You can cut decorative designs in leather, cardboard or other soft materials with an ordinary corrugated fastener. To cut perforations in paper or cardboard, punch only the teeth through the material.

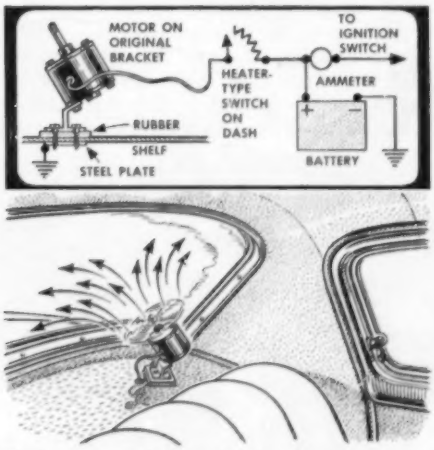
Old Pots Make Bird Feeders

Want a simple bird feeder? Screw a discarded pot cover to one end of an 8" length of broomstick and an old pie tin to the other end, as at left. Use a screw eye on top for attaching string to hang it from a limb.

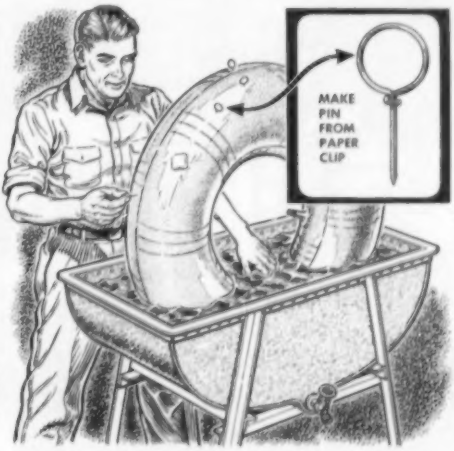
Hints FROM THE MODEL GARAGE

A handy snack table for two is easy to make from an old sun visor. Position and bolt the bracket to the dash so that the visor swings under it when not in use. Use a second, U-shaped bracket to support the downward-hinging edge of the extended visor.

When a trailer has a flat, it's hard to see it from the tow car. Place two strips of tape on the trailer front where you can see them in the rear-view mirror just above the lower edge of the car window. If a strip drops out of sight you know there's a flat.



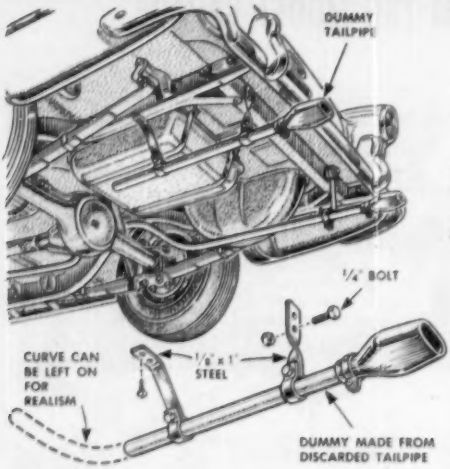
For a rear-window defroster, attach an old car-heater fan to the parcel shelf. Cushion it with rubber. Use a grounded metal plate under the shelf as a screw anchor. Rig a variable-resistance switch on the hot side of the ammeter to feed the motor.



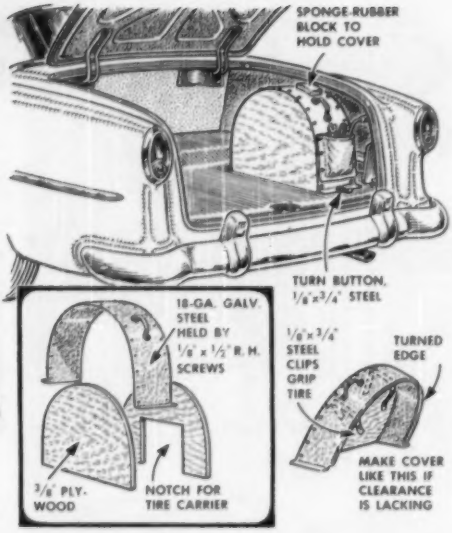
To mark leaks in tubes, one garageman twists skewer-shaped pins from stiff wire. He hangs them on a peg near the test tub and inserts one in each puncture he finds. When he gets around to repairing the tube, he replaces the pins on the peg.

Please turn the page for more auto hints

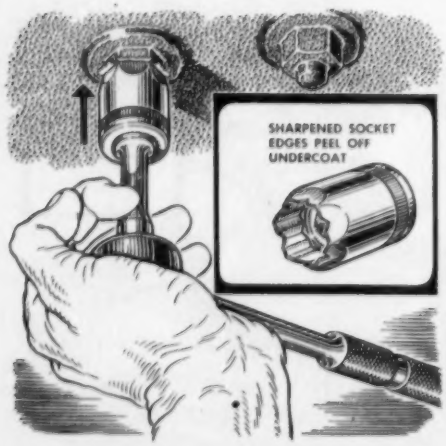
MORE Hints from the Model Garage



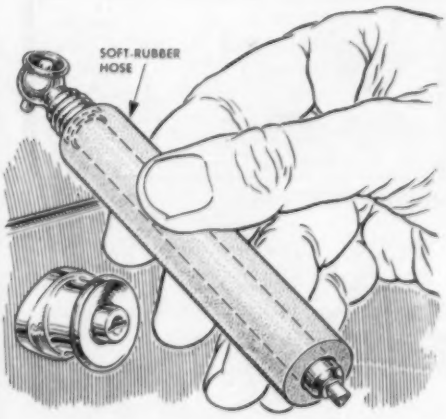
That dual-exhaust effect for the going-away view can be produced this way if you don't want the real thing. Scrounge around an auto junk yard until you find a suitable tailpipe. Then bracket it opposite the real one and clamp on twin chrome extensions.



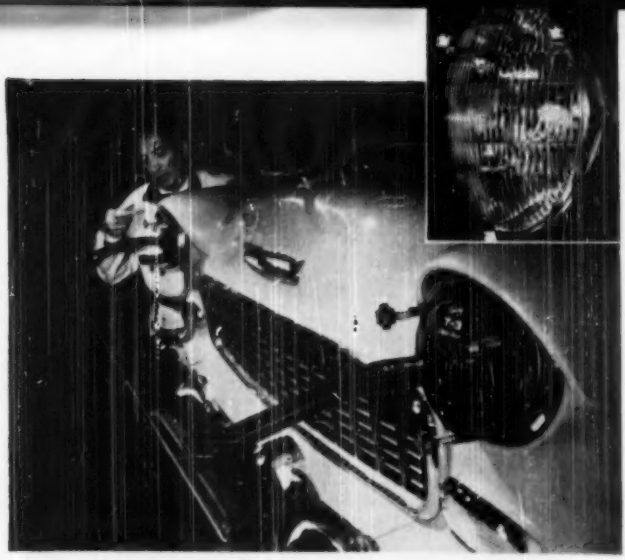
A tire cover like this will help keep a trunk compartment clean and prevent smudges on clean luggage or packages stored there. A dirty tire and wheel ought to have a good washing before going into the trunk, but there's seldom a chance for this.



Hard undercoating makes it difficult to remove body and fender bolts from a car that has had a heavy application. To speed the operation, one shop owner uses sockets ground to a sharp edge like this. The knife edge cuts right through the coating.



A tire gauge carried in a toolbox or the glove compartment will be protected and won't cause an annoying rattle if you locate rubber hose of the right diameter, cut off a piece and slip it on the gauge. You can take readings without removing it.



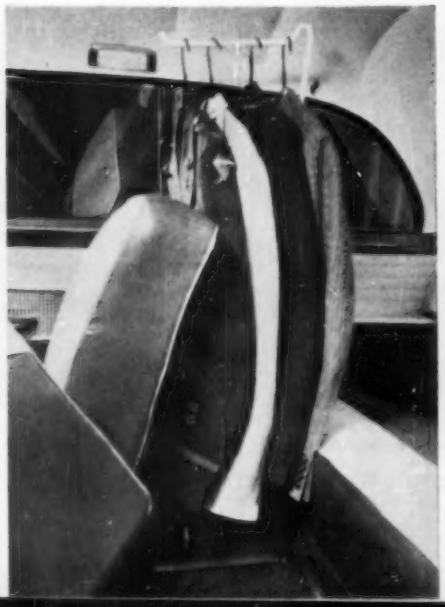
New for Your Car

1. Headlights Easier to Aim. A new system of adjusting headlights, developed by General Motors for installing its new improved-visibility lamps, makes it possible to aim them accurately in daylight and without a wall chart. Built-in guide points—three glass knobs cast in each lens (inset)—enable the installer to set the sealed-beam lamps correctly by fitting them to the leveling device shown in use at left.

2. Map Figures Mileage. Locate yourself on this map (right) by sliding an insert until a dot appears at your town. Then you can find the distance to your next stop or for a complete trip. Small windows show the information. A series of 16 sectional maps covers the principal cities.

Further information on these new car products can be obtained from: 1. AC Spark Plug Div., GM, Flint, Mich.; 2. Sayles-Wilson, Inc., 527 W. 39th St., Kansas City, Mo.; 3. Hopkins Co., 430 National Rd., Wheeling, W. Va.; 4. Tyrex Sales Corp., 71-09 Austin St., Forest Hills, N.Y.

3. Clothes Rack Stands in Car. This portable rack, holding up to 10 pressed suits between front and back seats, can be taken into your motel room or cottage without removing the clothes. Between trips, it may be stored in the trunk or used in your home.



4. Fix a Flat Without a Jack. A new tubeless-tire repair kit makes it possible to fix a flat along the road without jacking up the car. You squirt liquid rubber into the puncture with a sealant gun. You then connect the flat and spare with a 16′ hose, permitting excess pressure in the spare to inflate the flat.

ALMANAC
FOR MOTORISTS

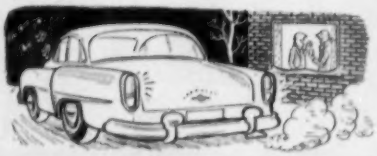
Pithy proverbs, provident counsel and omens and portents of interest to horseless-carriage operators.

▸▸**The rear window** of the car ahead is frequently informative. Beware the driver in front who is one of those head-turning conversationalists, or who is bundling with a gal. He isn't really with you.

▸▸**Good remedy** for a speedometer that has developed ticks and twitches: Disconnect the cable at the instrument, withdraw the inner core, and coat with light oil and graphite.

▸▸**One skid preventer** is to keep informed on exactly how slippery constantly changing road surfaces really are. You'll get many clues from the steering wheel and accelerator.

▸▸**It's mean to a car** to make only short trips in bitter weather. Crankcase dilution is worst if an engine never gets hot. So try to make complete warm-ups the general rule.



▸▸**In winter a battery** is like a small bank account. To nurse it along, avoid unnecessary withdrawals—such as a prolonged idle with the radio, heater, and lights spending amperes recklessly.

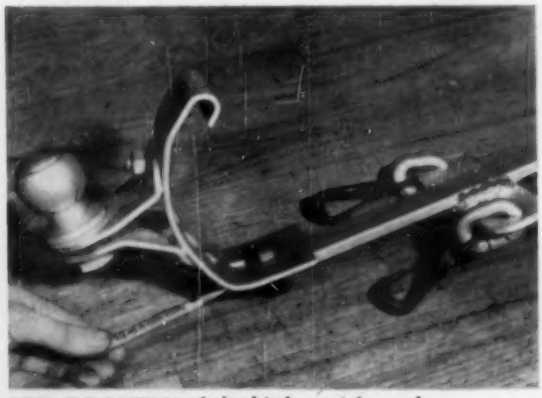
▸▸**Don't be pleased** by the throaty sound of a muffler that's beginning to rust through. Always hazardous, a worn-out exhaust system is especially so in closed-window weather.

Bumper Hitch Made Solid by Adding Iron Strap

You need not be annoyed by a trailer jerking as you drive with a bumper hitch. Tie the hitch to the car frame as well as to the bumper.

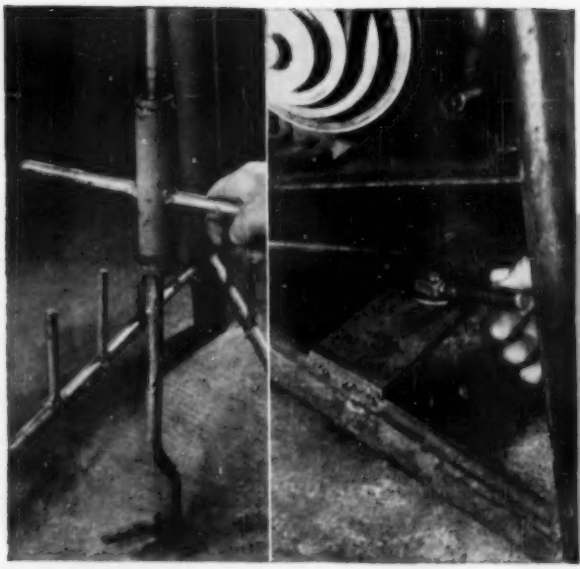
A piece of strap iron run from the bottom of the hitch to the frame eliminated most of the flex in my hookup. A little bending to tailor the hitch to the bumper may also help.

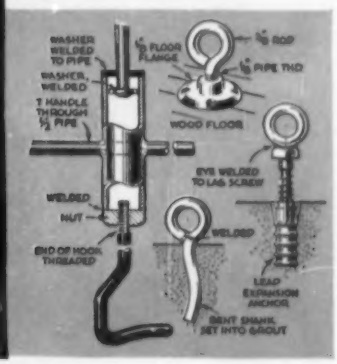
Weld a crosspiece to the longitudinal strap iron, add a pair of harness clips, and you have a fast way to hook up the safety chain.—*Jim Miller, Moline, Ill.*



BEND THE BOTTOM of the hitch at right angles to the bumper and bolt the strap iron to it.

NEW Shop Ideas





Securing Shop Stands. Three-legged stands in our shop are firmly anchored by the two methods shown in the photos above.

The method pictured at the extreme left uses a hook fastener and a tightening sleeve. As the T handle is turned, the sleeve swivels on the upper rod and draws the threaded hook against an eye set in the floor. No vibration or side pressure can move a stand that is fastened in this way.

The other method requires a plate bolted or welded across the lower rails of the stand. A ½" steel rod, formed into a hook at the lower end and threaded at the top, is drawn up by a nut on top of the plate. A handle is welded to the nut.

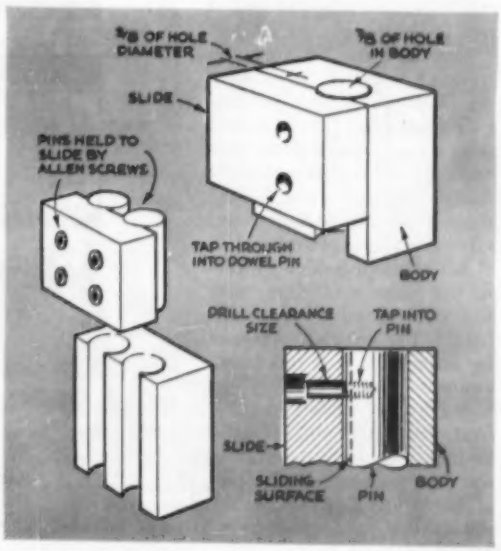
We make the floor eyes from ¾" rod, welding the loop for added strength. The drawing above shows three ways of anchoring them.—*Ken Hadenfeldt, Storm Lake, Iowa.*

Easily Made Tool Slide. Dovetail slides can be made only by milling or shaping. But by using steel dowel pins you can make accurate tool slides on your drill press.

Clamp the sliding surfaces together. At one end, lay out one or more holes with one-eighth of their diameter in the slide and seven-eighths in the body. With the joint parallel to the drill-press spindle, drill and ream the holes to a close fit for the pins.

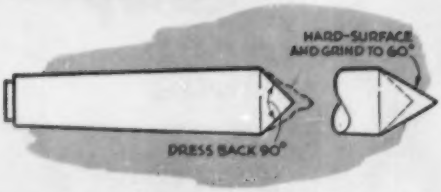
Before unclamping, insert a pin in each hole. Drill through the slide into the pins. Tap holes in the pins; then enlarge and counterbore the slide holes for Allen screws to hold the pins.

If the slide works too freely, remove the pins, wrap them with abrasive cloth, and lap the shallow grooves. This lets you "take up" the slide to any degree.—*R. J. Lemp, Sayville, N. Y.*



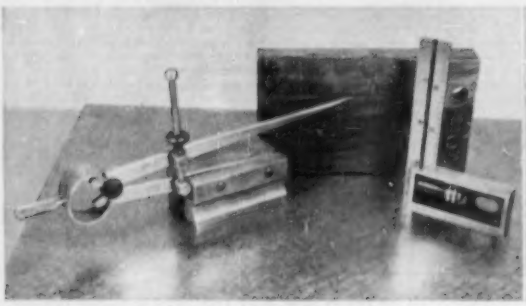
Please turn the page for more shop tips

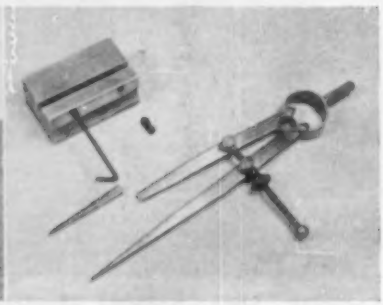
MORE SHOP TIPS



Renewing Lathe Centers. Damaged centers can be made better than new by hard-surfacing with Stellite or the like.

Rough-grind the point back at an angle of 90°. At a welding shop, have the tip hard-surfaced. Clean up by grinding; then in the lathe grind accurately to 60°. The point will withstand high heat and pressure, outlasting (in my experience) even high-speed centers.—*M/Sgt. James R. Wood, 465th Field Maintenance Squadron, A.P.O. 83, N.Y.*

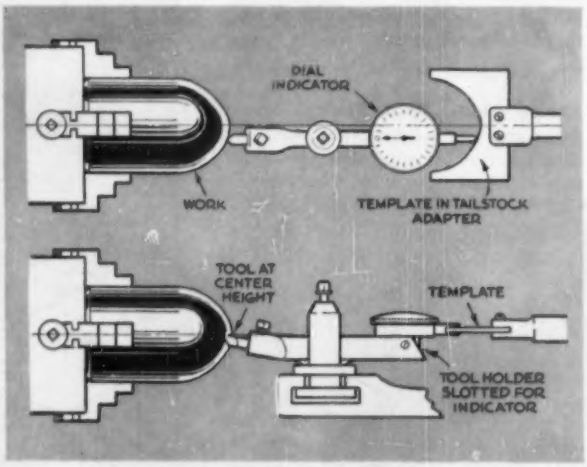




Make a Surface Gauge. Handy for small work in the home shop, this surface gauge is a quick job if you have a mild-steel block and a pair of dividers—the two major items needed to make it.

Slot the top of the block $\frac{3}{16}''$ by $\frac{1}{2}''$. Tap holes from one edge for setscrews. Cut one leg of the dividers short and clamp it in the slot at an angle as shown. The finger-grip grooves in the edges of the block are optional. For greatest accuracy, case-harden and grind or lap the bottom flat.

Turning Face Contours. Convex, concave and even compound curves can be turned with a template and a dial indicator.

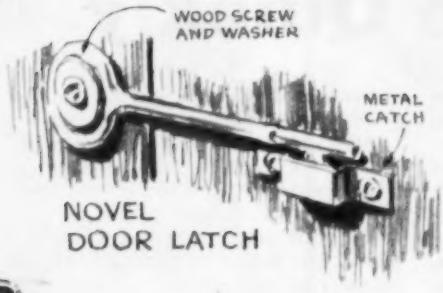


Saw and file an accurate, full-size negative or reverse template of the desired contour from plate brass. Mount it on a taper shank in the tailstock. In the end of a straight tool holder, mill a slot to hold the lug of a dial indicator and tap for a clamp screw.

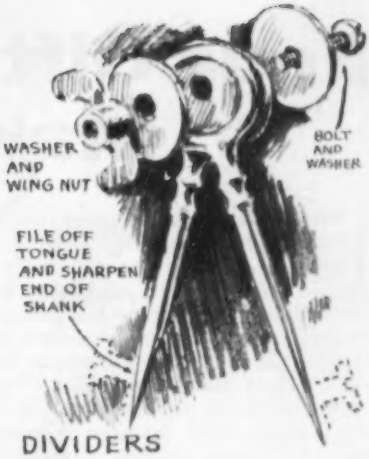
Set the tool holder parallel to the lathe centerline, with the cutting edge at center height. The template need not be on center; it is most convenient somewhat higher. Using a low spindle speed and power cross feed, manipulate the carriage hand wheel to maintain a constant indicator reading as the tool traverses the stock.

Small deviations on the roughing cuts will not matter, and practice will soon enable you to keep the needle steady on the finishing cuts. In fact, it is surprising how soon the operator gets the feel of this method. Although the indicator follows only half the template, the full template is handy for checking.—*H. J. Gerber, Stillwater, Okla.*

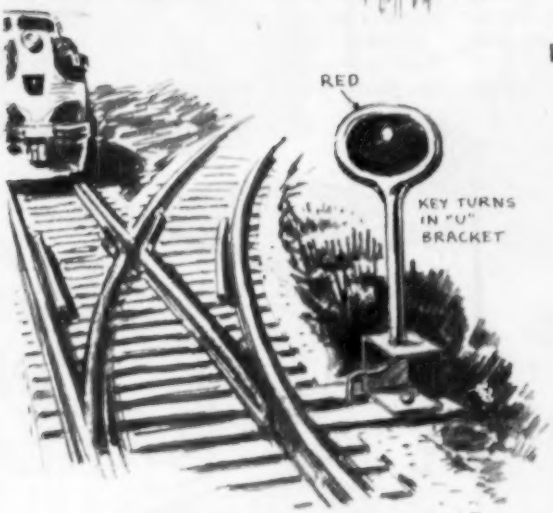
6 USES FOR Old Keys



NOVEL DOOR LATCH



DIVIDERS



MODEL RAILROAD SWITCH STAND

WORK GLOVES HOLDER

SCREW-DRIVER

COSTUME JEWELRY

Four Gifts You Can Make Quickly

1 **Plastic Jewelry.** Color and sparkle can be sealed into plastic, which may be cut into attractive one-of-a-kind jewelry pieces. Pour ethylene dichloride into a bottle that you can cap. Dissolve enough Plexiglas sawdust in it to make a syrupy cement. Cut a piece of black or colored Plexiglas and one of clear about 3″ square.

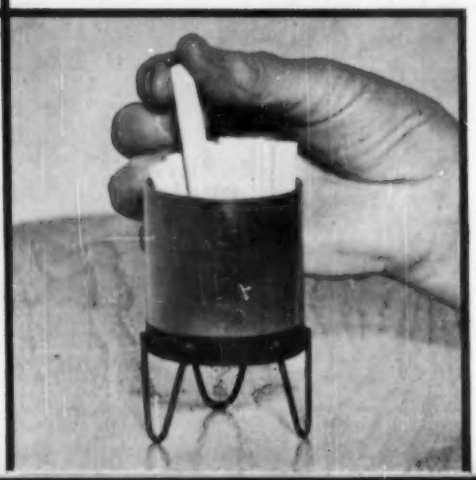
On the opaque piece, arrange foil or thin wire shapes, pearl flakes or sequins, and dust with bronze powders or glitter (both come in colors). Cover the clear sheet with cement, invert it quickly over the other and weight it down lightly.

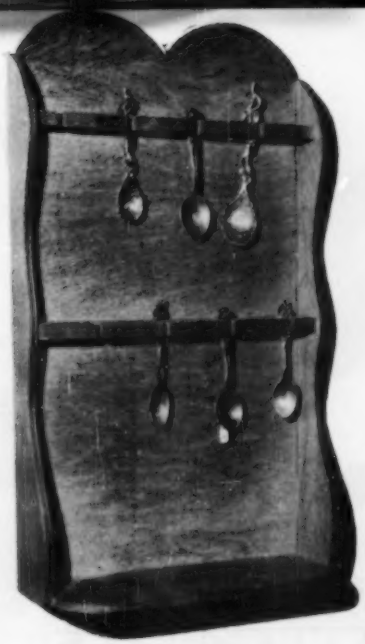
After 24 hours, mark a circle, oval or other design outline with a china pencil. Use a jeweler's saw to cut out the form that you've drawn on the plastic "sandwich." Smooth the edges with wet silicon-carbide paper, and polish by buffing lightly or by brushing on pure solvent.

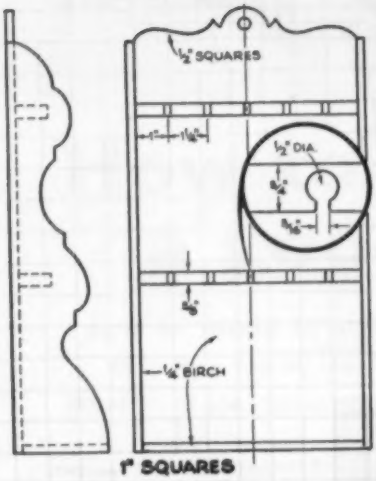
Cement fittings to the back, or sink small screws or eyes by heating them into the plastic with a soldering iron.

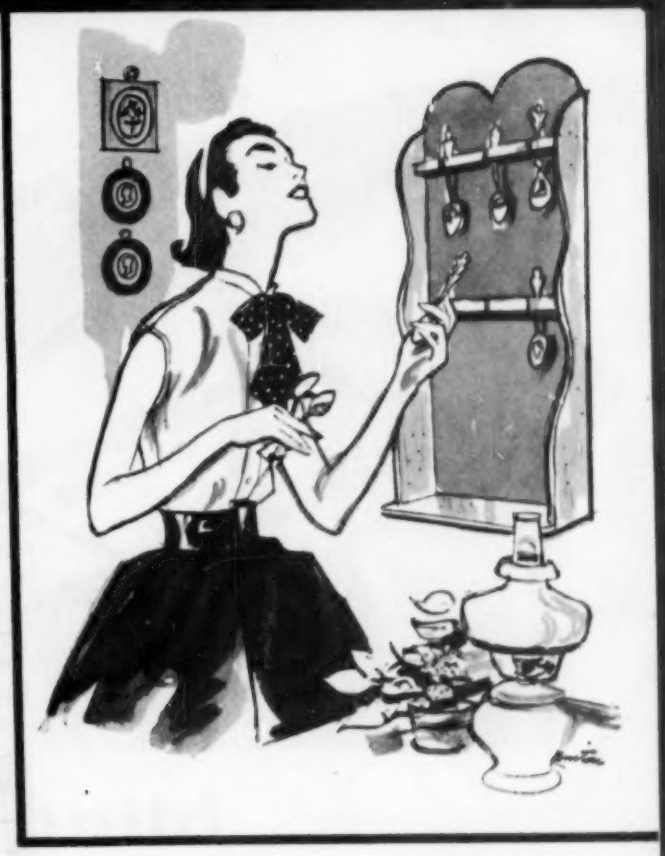
2 **Cigarette Box.** Cut a 2¼″ length from a piece of 2″ copper vent pipe. Solder a disk of light-gauge copper in one end. Bend three U-shaped legs from copper or brass wire and solder them to the sides near the bottom.

Polish the cylindrical box and legs with steel wool and apply a coat of clear lacquer or, for a contrasting effect, mask the upper part of the box and paint the lower area flat black.





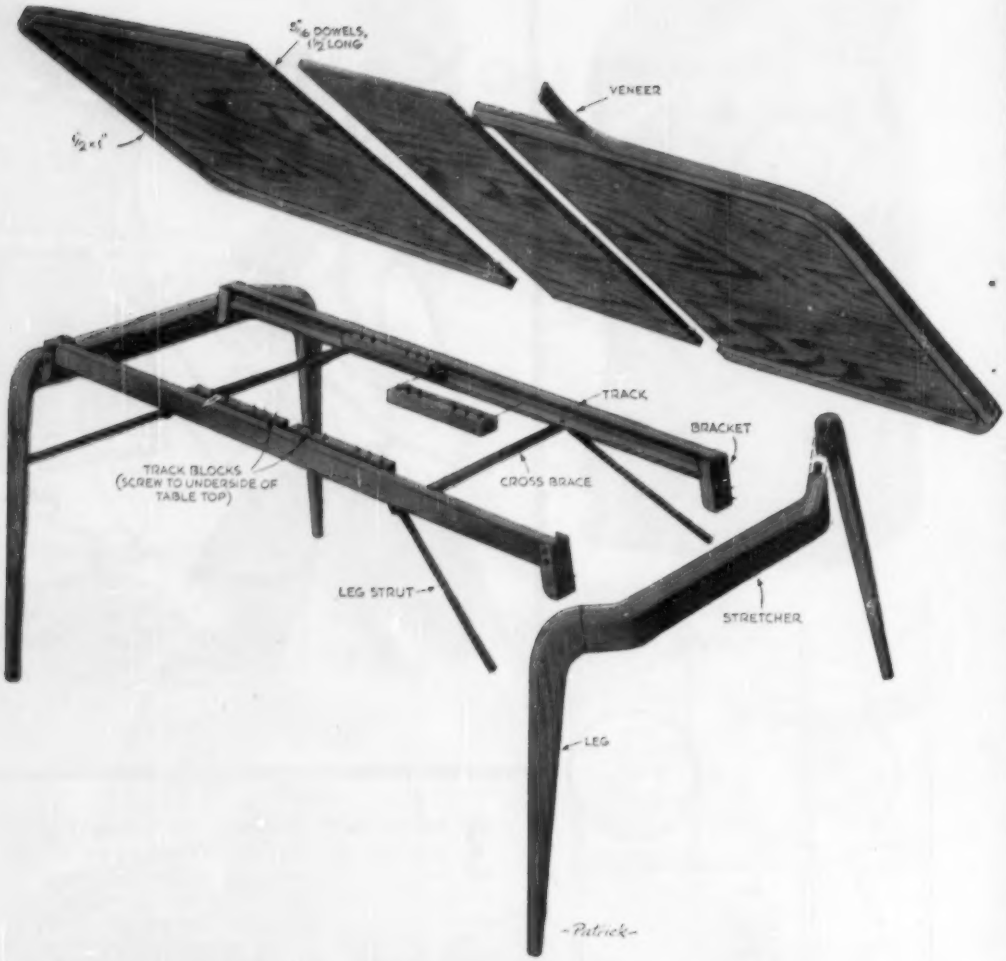




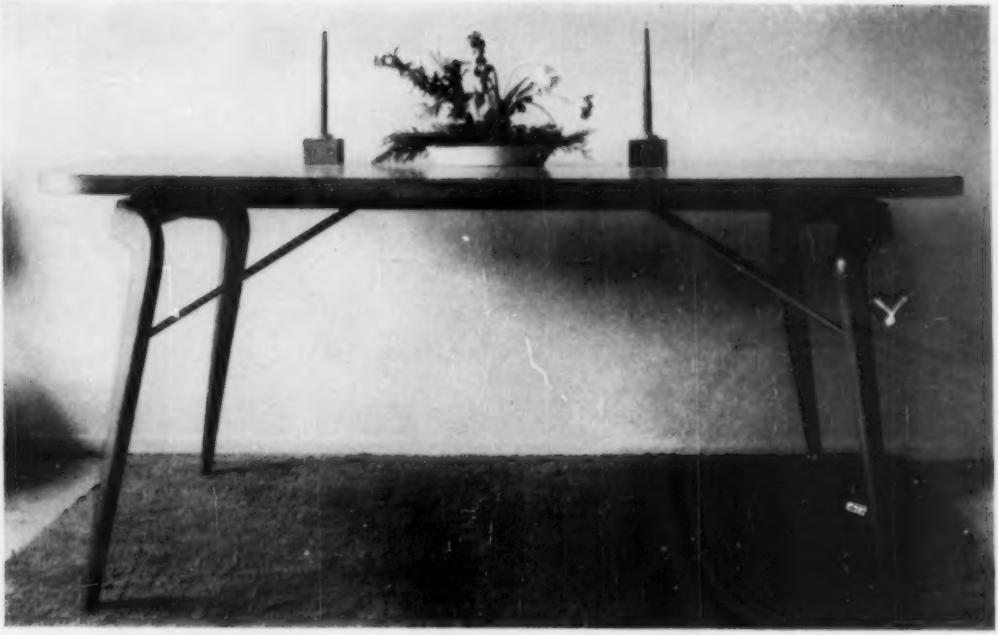
3 Spoon Rack in Birch. For the early American style in the photo, lay out identical sides with a simple, wavy line. Draw the top of the back with a compass. For a more formal design, transfer the patterns in the drawing.

Use ¾" stock for the spoon holders. Bore ½" holes and cut 3/16" slots to meet them. Assemble with glue and brads. Finish with wax, and apply screw eyes to the back for hanging.

4 Chairside Table. Smart as it looks, this handy piece is made of cardboard and a baking tin. The tin used is 12" in diameter and 1½" deep. Roll an 18"-wide strip of corrugated cardboard into a cylinder around the tray and under its lip. Two overlapping turns make a surprisingly strong base. Fasten the end with glue and a few staples. Paint the cardboard or wrap it with rings of colored tape.



EXPANDING FOR COMPANY, this sleek dining table takes two leaves that provide comfortable room for 10 people. When extra seating space is not needed, you store the leaves in the convenient pocket formed by the aluminum extension tracks (left) and close the top. The top slides freely on the tracks, which are screwed to the curved legs to form a rigid base unit. You don't have to move the legs to open or close the top.



How to build a good dining table

You'll be proud to show off this fine table, designed for PSM by a master craftsman.

By Frank Dorr

HERE is a table for the night the boss and his wife come to dinner. Mrs. Boss will be impressed by its beauty, for this stunning job exudes hang-the-expense refinement.

Mr. Boss will be impressed when you let him peek underneath at the aluminum-channel extension tracks. If he says admiringly, "Never saw anything like that before!" he's right. The aluminum structure is unique. It's another neat dodge that custom cabinetmaker Martin Stan Buchner has devised to help amateur craftsmen build superior furniture.

The table, designed and built by Buchner especially for POPULAR SCIENCE MONTHLY, offers plenty of elbow room

The smart dining table described here is the work of cabinetmaker Martin Stan Buchner, winner of many design awards and custom builder of fine furniture (The Buchner Co., Whippany, N. J.). At right you see how your table will look with its matching chairs and buffet.

for six people when closed, 10 when extended. It matches the side chairs described last month (p. 178) and a server-buffet that will be detailed in the January issue.

The aluminum frame holds the table up. The legs and stretchers are rigidly attached to it (not to the top). This makes a structure sturdy for the ages, as practical for everyday meals and children's homework as it is for company dining. It eliminates cumbersome side aprons and provides storage space for the extension leaves.

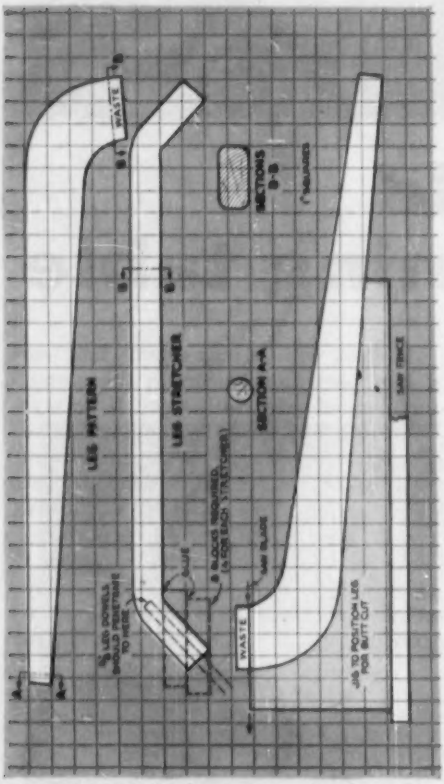
The aluminum stock you make it from is standard stuff, ⅜″-by-1″-by-2″ channel. Most big building-supply and hardware firms handle it.

The top. You see the touch of the

LEGS Angle for butt joint between leg and stretcher is cut after the leg has been bandsawed to template contour. Hardwood stock is 4″ wide, 1⅜″ thick. The jig shown in the pattern drawing holds leg in photo above.

STRETCHERS Glued-on blocks provide stock for curved ends. Wood for the blocks and main piece is 1⅜″ thick, 2⅞″ wide. When glue sets, bandsaw the ends.

ASSEMBLY Make your own furniture dowels (commercial ones aren't long enough). End of screw in jig hole cuts glue-holding spiral as you twist dowel through.



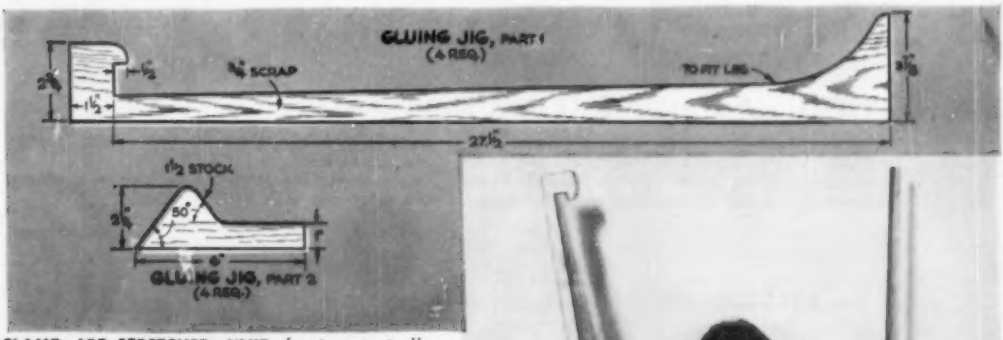
CUT TEMPLATES for leg and stretcher by scaling up these patterns on cardboard or thin plywood. Pattern at right shows jig you will need to make an accurate butt cut at top of the leg.

TO TAPER THE LEG, mark bottom end with centered 1" square. Take 3/16" off at the start on both sides, tapering the cut to leave full thickness near the upper end. Smooth with plane. Save scrap to level the leg for shaping.

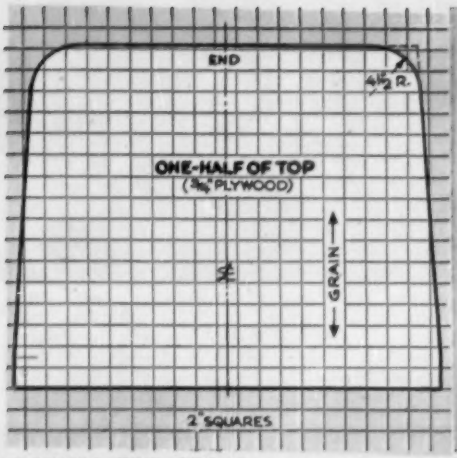
SHAPE LEG (and later stretcher) with ½" rounding-off cutter. To avoid splitting, stop short of ends and finish them after assembly. Taped-on wedges, which level surface of leg, are removed for hand-finishing of bottom end.

STRETCHER ENDS ARE CUT at 90° for joint with legs. Brace stretcher against 42½° angle block clamped to miter gauge. Same block braces the stretcher for indexing the dowel holes.

LONG DOWELS must go through glued-up ends into the main section of the stretcher. You may have to finish up the holes with an auger to get deep enough. A doweling jig is a necessity.



CLAMP LEG-STRETCHER UNIT in two-part jig (sketch). C clamp holds part 2 on stretcher; hand holds part 1 until pipe clamp is tightened. After glue sets, finish shaping by hand.



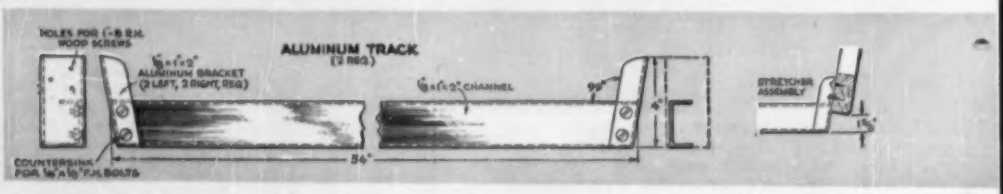
MAKING THE TOP Lay out pattern on plywood sheet to center attractive grain pattern, while leaving enough stock for leaves. Leaves are simply 14"-by-40" rectangles. Cut one half of top first, then flip it over and use as a pattern for the other half.

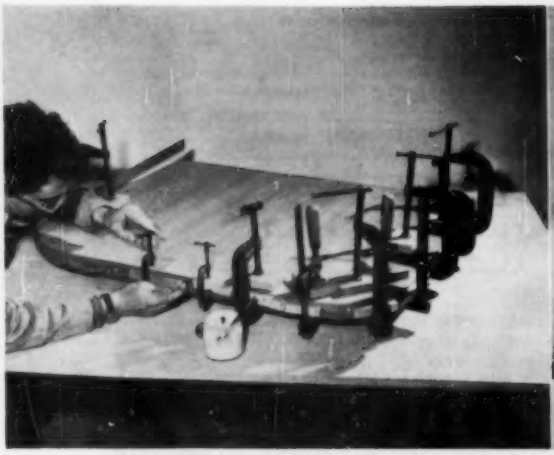
STRIPS of ½" plywood, glued and bradded around the under edge of the top, stiffen it and make it look more solid. To sand these strips perfectly square with the top, use an L-shaped sanding block as shown above. Do not put similar strips on the leaves or they won't nest.

ASSEMBLING ALUMINUM TRACKS AND LEG UNITS

BOLT ON END BRACKETS with nuts and lock washers inside. Tracks and brackets are hacksawed from same stock (sketch below). Paint everything but the sliding edge to match wood.

SCREW END BRACKETS TO STRETCHER, spacing the tracks temporarily with a stick 19¾" long, and spacing the stretcher off the underside of the table top with a 1⅜" block.

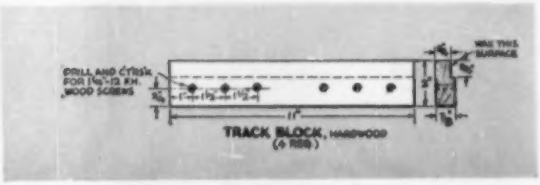




USE EVERY CLAMP in the shop to put the 3/32" veneer around the edge. Start at one end and glue by sections. Small wooden wedges are driven between the clamp bodies and the workpiece to put pressure on the veneer. The veneer is ripped from the leg-stretcher stock.

HOLES FOR ALIGNING PINS must be precisely indexed at center and 4" in from each side of the top. Pins are 5/16" dowels 1½" long, with their projecting ends rounded. Make a trial assembly and correct errors before gluing pins in place. Leaves also need aligning pins.

HARDWOOD BLOCKS, rabbeted on table saw for a sliding fit on tracks, are screwed temporarily to underside of top. Bullet catches, inset in blocks and engaging holes in track, are optional nicety. They make it easier for one person to set the top to just the right position.

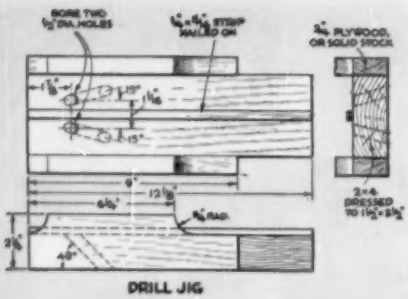


master designer here, too, in the gentle taper of the sides. The taper looks good, but more important, makes for pleasanter dining—guests sitting side by side can see each other while they talk and eat.

You cut the top from a full 4'-by-8' sheet of ¾" lumber-core plywood having one good veneer face. This isn't cheap, so choose it with care. Look for one with repeats in the grain pattern approximately centered. Lay out one half of the table top so that it will join the other half in the center of a grain repeat, matching attractively.

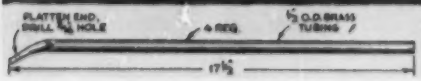
Extension leaves are cut from the same plywood sheet, so allow for them in your layout. They can be cut together or separately from either end, since they will not match the grain of the main top.

You need several jigs to get the legs and stretchers right. Most are simply scrap sawed to size or angle, but a few involve bandsawed curves. The jig for drilling the leg-strut hole, which has a compound angle, is detailed in a drawing. This jig's angled holes are easily made on a drill press: Mark the drill-press table with 15° angles on either side of a centerline; tilt the table to 48°; then line up the jig body with one angle mark



DRILL JIG

HALF-INCH HOLE FOR LEG STRUT is drilled with jig that fits right and left legs. With center strip of jig pivoting on leg, rock it into position and clamp it.



BRACES Insert leg strut and use pre-drilled hole in flattened end to locate hole in track for 3/16" bolt. Leg end of brace is drilled for 1½" No. 8 roundhead screw.

CROSS BRACE, which also supports stored leaves, is assembled with leg strut. Now try sliding action of top, re-position track blocks if necessary, and screw everything down tight.

for one hole, shifting for second hole.

Legs and stretchers are made of hardwood. Ask your lumberyard to dress them to 1⅜" thickness. You'll need one piece at least 9' long, so that you can rip off two veneer strips, 3/32" thick, for edging the table top. Rip enough extra veneer for the extension-leaf edges.

The table takes about $40 in materials —and a good bit of sweating over a hot saw. But when the family sits down to it for Sunday dinner, you'll agree that it was worth it many times over. END

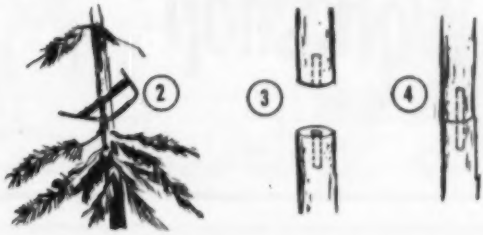
NEXT MONTH: How to Build the Buffet.

PLYWOOD STOP BLOCKS, glued and bradded on, center top when it is closed. To prevent warping, seal underside of top with same finish and same number of coats applied to top face.

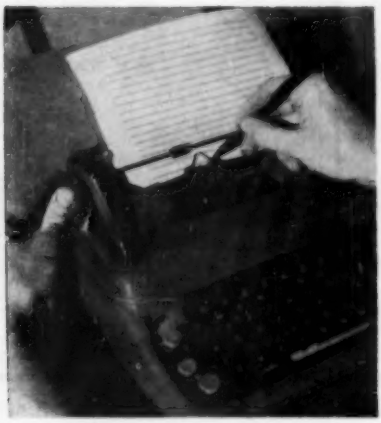
Two Poor Christmas Trees Make Good One

SPLICE together parts of two inexpensive Christmas trees to make one good tree. Here's how:

Saw a good top section (1) from a tree that's otherwise skimpy. Saw a good bottom section from another tree (2) that's rated imperfect because of a skimpy top. Bore a ½" hole 2" deep into the end of each trunk (3). Join the trunks (4) with a dowel glued in place.—*A. E. Cavanagh, Carle Place, N.Y.*



DO IT THE EASY WAY



TO DRAW PARALLEL LINES on blank paper, use a typewriter. Rest a pencil against the ribbon guide and draw the carriage from right to left.

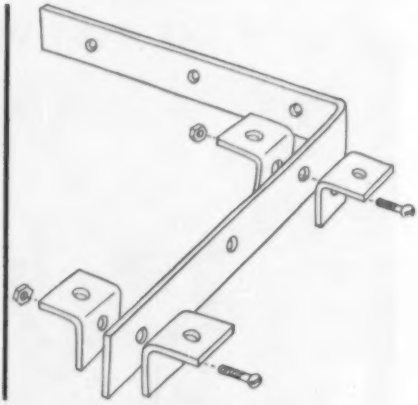
TO MAKE A CANDLE FIT a holder that's a little too small, size it with steel wool.

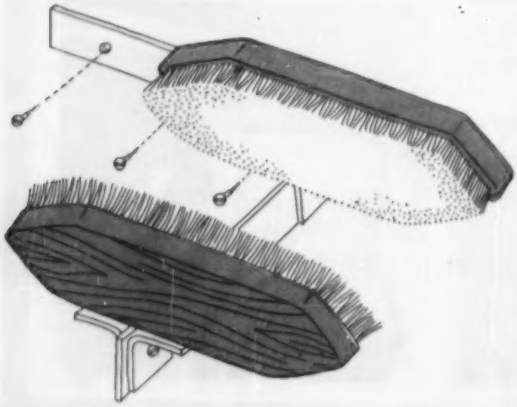
TO SEAL A SMALL BAG securely, fold it over a pipe cleaner and crimp the cleaner ends. Good for packaging party favors.

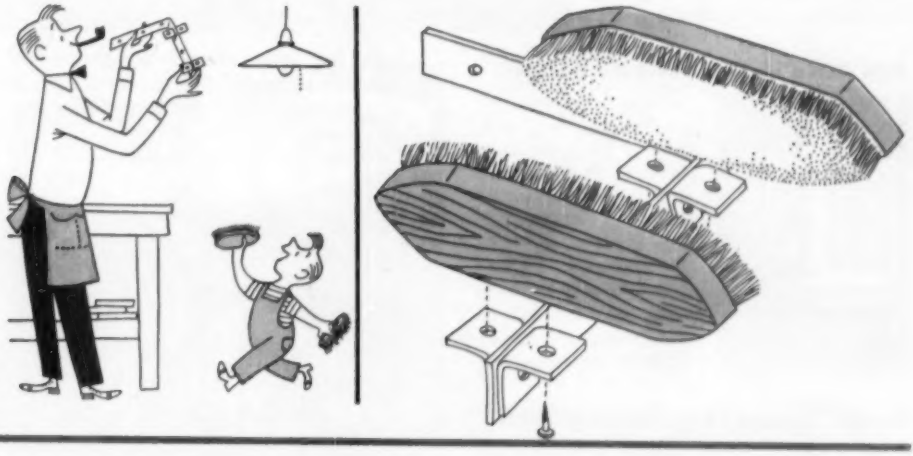
TO REMOVE OLD PUTTY with less trouble, coat it with linseed oil to soften it.

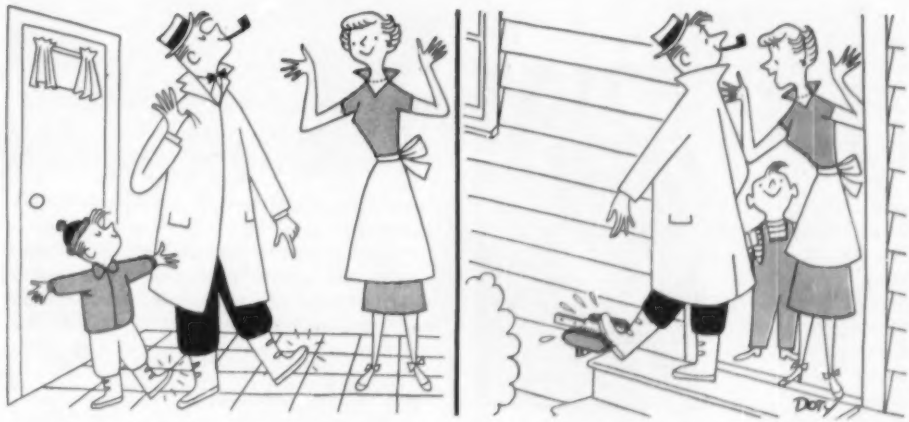
By Roy Doty and Thomas Ramirez

Wordless Workshop









Next Month: TV snack tables that you can store flat in a closet

Platform Locks Pail, Lets Lid Lift Free

You'll never have to wrestle a tight lid off a garbage pail if you lock it in a platform like this. And the hold-down will resist the best efforts of dogs and wind to knock over the can.

Space two 2"-by-10" planks ¾" apart and bandsaw a semicircular opening in the side of each plank to fit around the can. Bolt one leg of a flat brass corner to a 6" lever strip and the other leg to one of the two-by-tens. The lever pivots on a bolt in the second plank, as shown. Insert washers to adjust the spacing, and lock the bolts with double nuts. Kicking the lever separates the planks or locks them around the bead of the pail. *—Edwin M. Love, Palmdale, Calif.*

Old Auto Valve Rolls as Sander

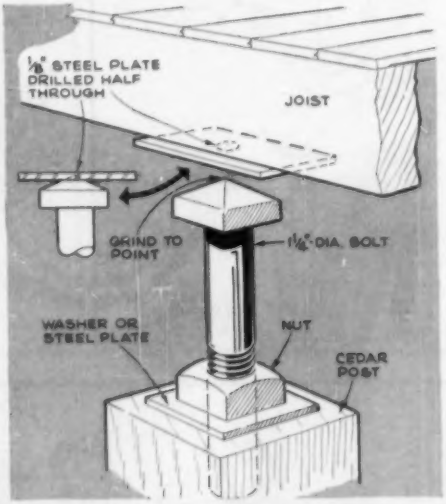
Small, no-cost disk sanders can be made quickly from old auto valves. Shorten the stem, leaving about 2" to grip in the chuck of a drill press.

Cement a rubber pad to the valve face and a sanding disk to the rubber. *—James Vick, Petersburg, Va.*

Drum Becomes Grinder Bench

A 55-gal. drum serves as a workbench and motor guard for this heavy-duty grinder. J. V. Rupert, Columbiana, Ohio, cut a motor opening at the foot of the drum and a belt-clearance hole at the top, then bolted the grinder on top and a switch box at the side.

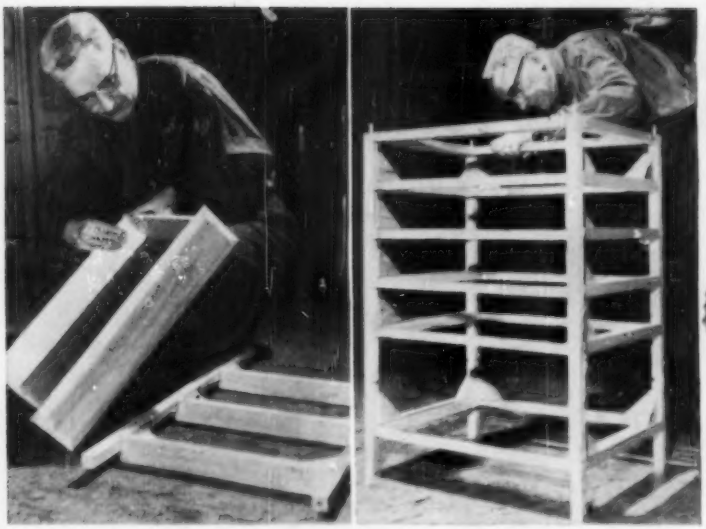
The wide base plus weight of the equipment keeps the bench steady, while its comparatively light overall weight makes it easy to move. *—John Krill, North Lima, Ohio.*



Homemade Jack Raises Floor

An inexpensive post jack now levels a section of sagging floor in my house. All it takes is a square-cut cedar post, a 1¼"-diameter machine bolt, a steel plate, and a washer and nut.

I cut the post a few inches shorter than floor-to-joist height, then bored the top to take the bolt. A rough point on the bolt head fitted against the ⅛" steel plate, drilled half through to serve as a bearing. Two wrenches jacked the floor easily. *—E. E. Chase, Winterport, Me.*



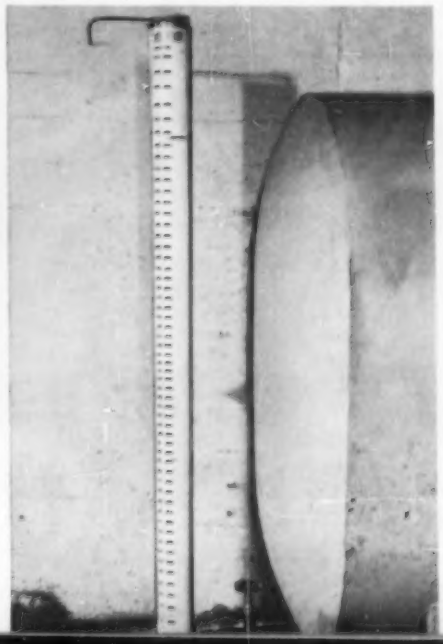
New for the Handy Man

1. Furniture Built from Kits. You don't need tools to construct a variety of furniture—from built-in cabinets to vanities. Just assemble and glue the interlocking members of this frame kit, and cover with plywood or other stock. You can also get and assemble precut drawers. Some latitude in design is possible: by using dowels in predrilled holes in the posts, you can stack units or join them side-by-side to suit your needs.

3. Bracket Holds Extra Shelf. Wherever you have a shelf already up, you can add another above it without using tools. Just tighten the two thumbscrews of this bracket onto the stationary shelf, and then fit a board across the two horizontal arms.

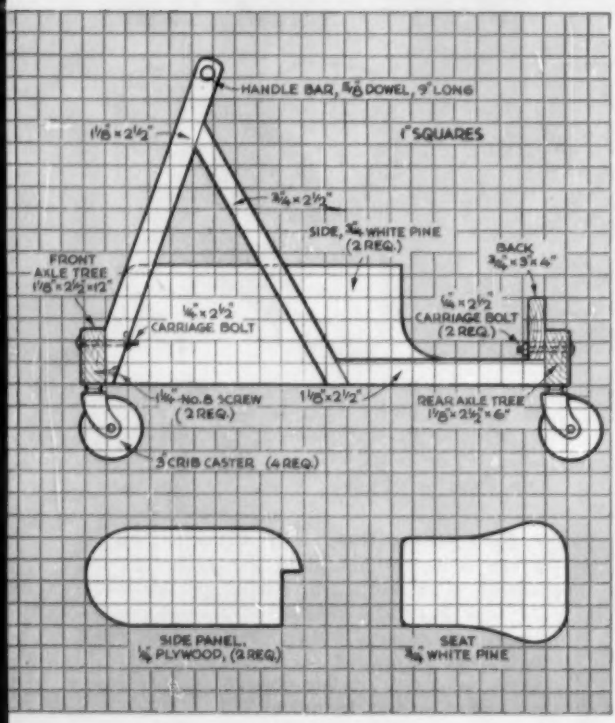
Further information on the products shown on this page can be obtained from: 1. Firpine Products Co., 8 N. State St., Oswego, Ore.; 2. Liquidvision Gauge & Control Corp., P.O. Box 51, Oceanside, N.Y.; 3. Wahl Specialty Co., P.O. Box 225, Monroe, Mich.

2. Fuel Gauge Read at a Glance. This gauge tells you almost to the gallon the amount of oil burned in a day, and left in the tank. It can be installed in the fuel line (between tank and burner) with a wrench and pliers. A magnet on a float inside the gauge moves an outside pointer on a scale graduated by fives from 0 to 275.



How to build a

Caster Scooter for the Toddler



A RIDING toy built for the toddling set must be simple to operate, for a child just learning to walk can't cope with pedaling or steering. But put a toy on big, easy-rolling casters and he instinctively maneuvers it to his heart's content. Add a wagon compartment and you have a toy that will remain a favorite for months. Construction is simple but rugged; the original has been in use for several years and is still going strong.

After completing the body, make up the axle trees (shown on the facing page), and drill holes 3/8" from the ends for the casters. Your hardware dealer calls them 3" rubber-wheel, grip-neck casters.

The original was finished natural with the exception of the seat and wagon compartment which were painted red. To complete the job, cut a wrap-around bumper from discarded rubber hose. Handle grips are 5/8" white-rubber crutch tips (size 17).—*Bob Johnson, Lakewood, N.J.*

1 ASSEMBLE THE FRAME FIRST, carefully sawing the angles shown in the drawing. Drill a 5/8" hole to take the handle.

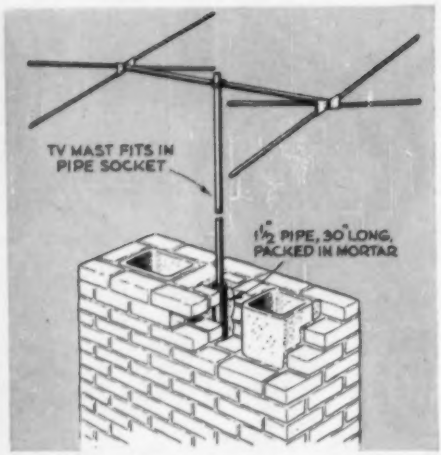
2 NAIL ON THE SIDES, which hold the seat, drill front and back for axle-tree bolts, and nail the back from below.

3 SIDE PANELS reinforcing the back are held by 4-penny nails (all others are 6-penny). Resin-coated nails hold best.

4 IT'LL BE A FAVORITE —with first-steppers or five-year-olds. It hauls dolly around in the house—or a play load of sand outside.

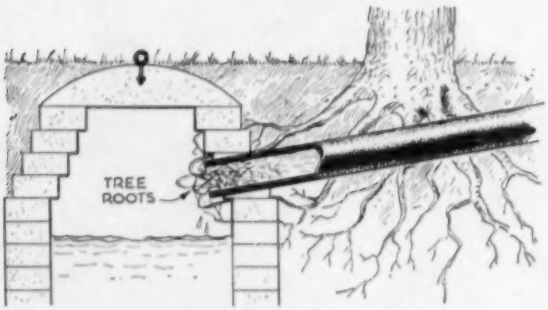
Mat Seals Doghouse Doorway

A RUBBER mat, cut in two, makes a fine wind block for any doghouse. Hinge the outer ends under wood strips; trim inner edges to meet at center, but not overlap.—*Virginia Whitman, Barnumton, Mo.*



Chimney Socket Holds TV Mast

IF YOU'RE building a house or a new chimney, here's a way to provide for a TV antenna. Embed a 30" length of 1½" galvanized pipe in the chimney mortar as a socket for the mast. Pack calking into the pipe to make weather-tight seal between it and mast.—*D. X. Manners, Norwalk, Conn.*



Extension Clears Pipe of Tree Roots

SOME time ago I was forced to open a cesspool because tree roots had clogged the soil pipe leading to it. The roots had driven through the tank wall and up into the discharge end of the pipe. A 1' extension of the pipe into the tank cured the trouble.—*Hi Sibley, Nuevo, Calif.*

Wood Strips Hold Switch

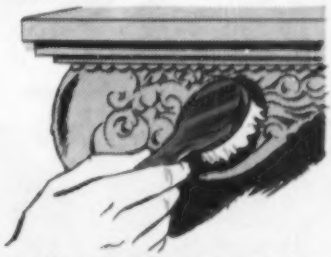
TO MOUNT a switch or outlet box on plasterboard, notch two wood strips (left) to clear the receptacle screws, and fasten behind the wallboard with wood screws driven from the front (right). Then mount the box.—*Herbert Y. Moon, Orient, L.I.*

KEEPING THE *Home* SHIPSHAPE

A TOY TUB will hold all the loot from Santa. It's a fancied-up washtub on hairpin legs. A plywood lid makes a fine play surface.

CHRISTMAS BELLS add beauty to a doorway decoration. Paint tiny flowerpots bright red or spray with artificial snow. Outdoor light bulbs for clappers add illumination.

A HINGED COUNTER will allow you to use an electric broiler without moving it from the cabinet. Cut through an end section of the counter so that it folds back against the wall.



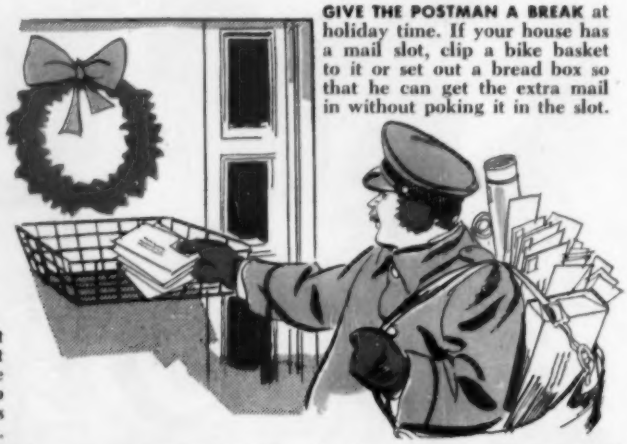
TO POLISH DEEP-CUT GROOVES in furniture to a sparkle, try a soft, new shoe dauber. It will get dirt out and polish recessed areas that an ordinary furniture duster usually misses.

Please turn the page for more home tips

More Home Tips

LIKE TO DISPLAY CHRISTMAS CARDS? Slip them over up-tilted slats of Venetian blinds. If the fold is at the side, tape the cards on the blind.

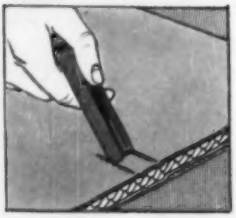
REFRIGERATOR NOISE won't trouble your sleep if you put small rubber pads under the feet of the box. They'll damp some vibrations, and keep others from going through wood floors.

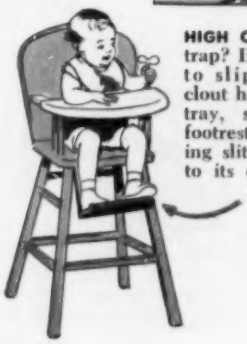


GIVE THE POSTMAN A BREAK at holiday time. If your house has a mail slot, clip a bike basket to it or set out a bread box so that he can get the extra mail in without poking it in the slot.

TAPE THE ENDS of cut evergreen branches when you decorate for Christmas. A wrapping of transparent or green-colored tape will keep sap from oozing out and leaving gummy stains.

A CLOTHESPIN is a handy tool for scoring a corrugated cardboard wrapping. The blunt wooden "knives" won't cut through the board, and the double scoring makes it easier to bend the cardboard tightly around your intended Christmas gift.



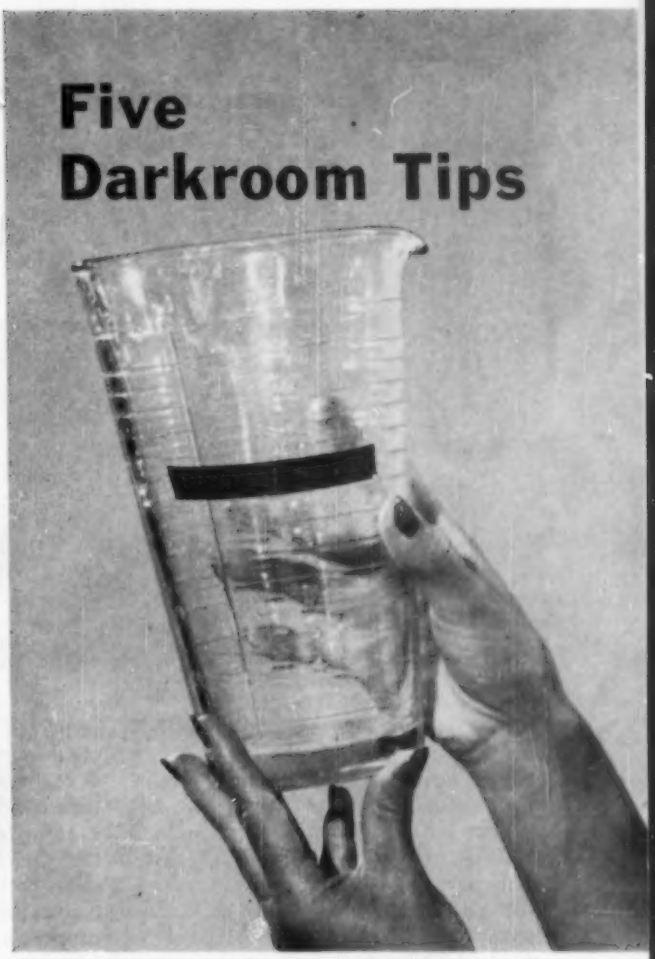


HIGH CHAIR a baby trap? If Junior tends to slip down and clout his chin on the tray, skidproof the footrest by cementing slit garden hose to its edge.

Five Darkroom Tips

1 PROTECT PRIZE PRINTS by spraying them with the clear plastic now sold in pressurized cans.

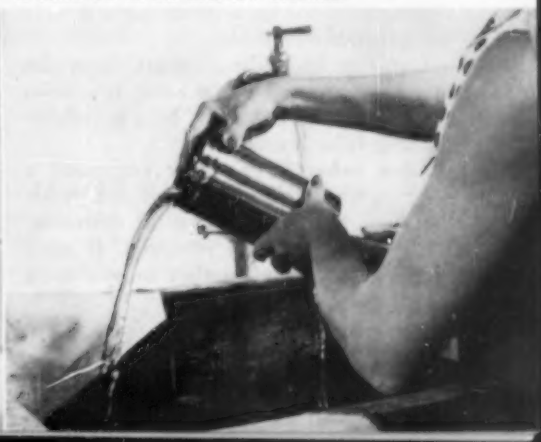
2 PUT THE HEAT ON developer on cold days with a photoflood lamp. It will raise the temperature very quickly to the desired 68°.



3 A MARKER placed at the most frequently used level on a graduate will help speed up measurements. A piece of colored cellulose tape stuck in place will do the trick.

4 A CHIP OFF THAT OLD TRAY will soon lead to a leak unless the spot without enamel is protected from the chemical action of the solutions. An easy repair can be made by painting the spot with fingernail polish. It dries fast.

5 WASHING TIME for film can be safely shortened if you dump the water from the tank and fill it again several times before leaving it under the running water. Nearly all the hypo is removed in the first few seconds.



Slide Viewer Made From Cans

By Walter E. Burton

KEEP a ruler in the kitchen, measure the assortment of cans that pass through the can opener, and you'll soon have the tin for this color-slide viewer.

Designed around a 50-cent magnifying lens from a mail-order salvage house, the viewer takes all color transparencies up to 2¼" by 2¼" in size.

Lamp house. Cut the parts from a large juice can, allowing ⅛" extra around each part for the tabs that join them and for rolling to eliminate sharp edges. Solder the parts together.

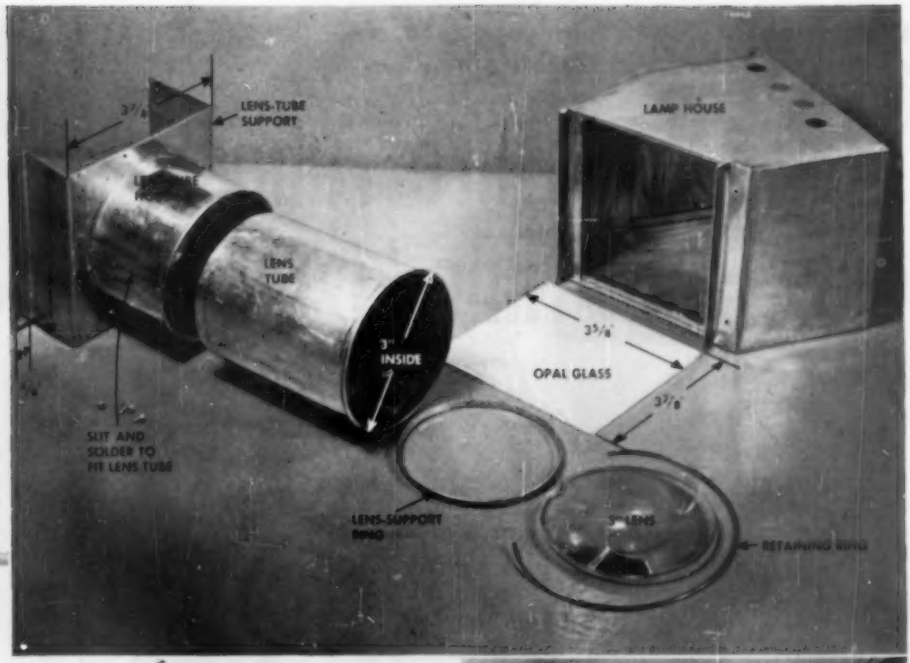
Use a 15-watt frosted bulb in a standard surface-mounting socket. Bend a piece of tin to a 30° angle and solder it inside the housing to support the socket. Press a rubber grommet in a hole for the lamp cord and wire it through a small canopy switch fastened in the side of the housing. Install a 3⅝"-by-3⅝" piece of opal glass with its white surface down. Bend the tin a bit to make it snap into position easily.

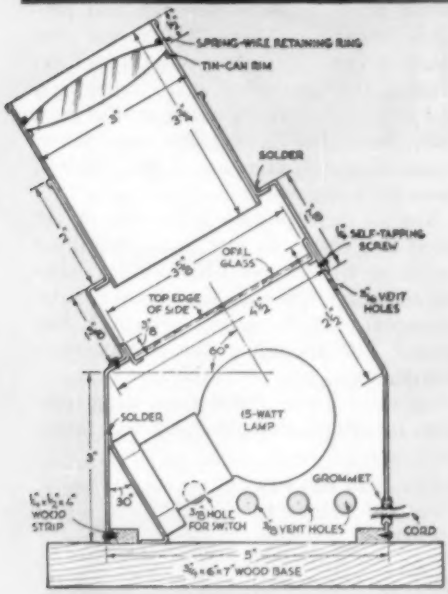
Cut the lens-tube support from flat tin and bend all edges over ⅛". Bend it to shape and cut a 3⅛" hole to receive the lens-tube housing.

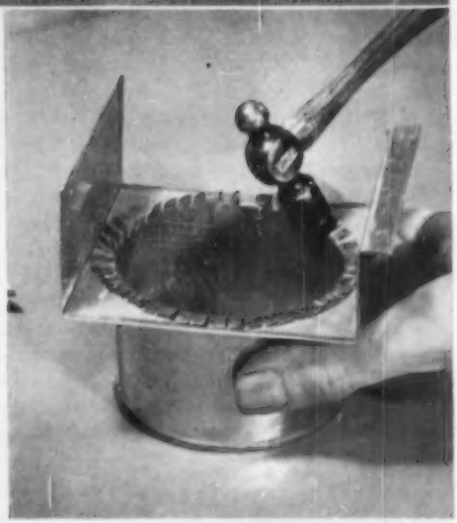
Lens tube. Here's why you need a ruler in the kitchen. The can that holds the lens must be 3" inside diameter. With the bottom lip removed, it must slide easily inside another only a trifle larger. If you can't find such a happy combination, slit the outer can lengthwise, overlap it until it fits over the lens-tube can and solder the seam. Then make a series of cuts around the bottom of the can, bend the tabs over and solder them to the lens-tube support (see picture at far right). Punch four holes in the support and fasten it to the lamp house with ¼" self-tapping screws.

Lens. Shop the surplus and salvage shops for a 3"-diameter magnifying lens of about 7" focal length (mail-order dealers stock them). Such a lens will magnify a transparency about 1½ times, and is just right for 2¼"-by-2¼" slides. For smaller slides, you could use a 2½"-diameter lens of 6" focal length in a shorter 2½"-diameter can. Solder a ring of metal (a can rim) to the inside of the lens tube about ½" from the top. Rest the lens on it and snap a ring of spring-brass wire inside the can above the lens to hold it in place.

Enamel the entire viewer except the outside of the lens tube, which must slide for focusing. Paint the inside of the lens







CUT SLITS, ¼″ deep, around bottom of lens-tube housing, bend tabs over on underside of support and flow some solder over them.

tube dull black to eliminate reflections. Mount the viewer on a wood base about ¾″ by 6″ by 7″.

When viewing slides smaller than the 2¼″-by-2¼″ size, you can center them under the lens by resting the bottom edges on a strip across the bottom of the opal glass. END

When your old picture tube goes dead, try reviving it before you install a new one.

TV Picture Tubes Have Nine Lives

By Art Margolis

AS A TV trouble-shooter I'm never sure what I'll find on a call. But I *am* sure of one thing. You don't always have to replace a picture tube when it starts to misbehave; it can often be revived.

The day that I was called to look at a baby-sitting TV set is a case in point.

The call came from a dress shop in a new modern shopping center. The center has a free baby-sitting service in the largest store. While paid attendants watch the children, a TV camera pans the play area. The picture is carried over a closed circuit to monitor sets in all adjoining stores.

Young mothers love the closed-circuit TV setup. They can shop in any of a dozen stores and still keep a watchful eye on their kids in the shopping-center play area.

The owner of the dress shop was practically frantic. His monitor, a 17-inch Philco, had lost its picture.

A quick look into the back and I had the trouble—a break in the filaments in the picture tube. These filaments are like those in a light bulb. When current is pumped through them, they get hot and start the picture tube perking.

Filaments can break either inside or outside the sealed glass. If they break inside, it's a tossup whether you can make a repair. But if they part outside, and most times they do, the picture tube can be easily fixed.

This one was typical. The open was in the pins of the plastic cap that protrudes out of the back. The repair consisted of putting the receiver on its face, heating the pins with a soldering iron and dripping a little solder onto the pins. That closed the break. The shop owner breathed a sigh of relief as the children came back into view.

Not all dead picture tubes can be revived this easily. In fact, many are dead for keeps. But the potential savings make the effort worthwhile. Replacing a tube averages $45. Reviving one may run around $10, including the serviceman's charge.

Let me tell you about some other near tube fatalities—and what caused them.

Art Margolis' anecdotes about his adventures as a TV serviceman are both entertaining and informative, a rare combination in electronics writing. Trained at Temple University, he now at 30 has eight years' practical TV experience behind him, six of those years as his own boss. Customers keep him mighty busy, but he still finds time to write articles for PSM (five in the last year and a half) despite two lusty youngsters who, he says, "have a pact to start yelling every time I sit down to write."

THE CALL CAME FROM A DRESS SHOP in a modern shopping center. The owner of the shop was practically frantic. His monitor, a 17-inch Philco, had lost its picture.

Low Emission

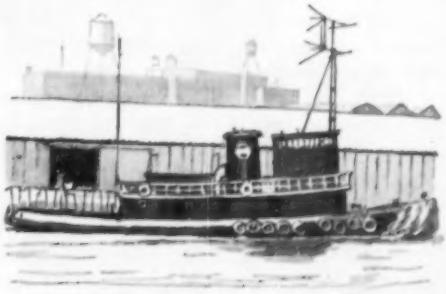
ONE of the most common defects of picture tubes is called low emission. The heat produced by the filaments warms the cathode, which is coated with barium oxide. When barium oxide is heated, it can shoot out a beam of electricity. This beam lights up the picture.

Over a period of time the outermost layers of the barium oxide become poisoned from tiny amounts of gases that float around in every picture tube. Without full aid of the oxides the cathode ray loses its intensity and the picture loses its brightness. That's low emission.

I received a call one day from Pier 10. A 21-inch RCA on a tugboat was suffering from an acute case of low emission. Only at night could any picture be seen.

A couple of years ago I would have had to put in a new picture tube. But not today. For while the surface of the barium oxide was wasted away, the under layers were like new.

I pulled the cap off the picture tube and installed a special filament trans-



former between cap and tube. This raised the filament voltage 25 percent. That raised the heat of the filaments, the cathode got hotter, the barium oxide reshuffled its layers and the cathode ray once more struck out hard and crisp. The result was a perfect picture. This little transformer is on the market. Ask for a cathode-ray-tube booster transformer.*

The one shown in the accompanying photo has a high-low switch on it. A moderately weak tube can be brought to life with the switch in low. Later when the emission drops with further aging, you flip the switch to high—and replacement of the tube is again deferred.

Everyone asks whether this treatment won't hurt the filaments. The answer is no. All cathode-ray-tube filaments are rated at least 100 percent above their normal operating voltage. The little transformer raises it a mere 25 percent. Eventually, of course, after enough years have elapsed all of the barium oxide will become poisoned, but the resuscitation procedure really stalls replacements. The tugboat call occurred two years ago and the captain's tube is still going strong.

Filament-to-Cathode Short

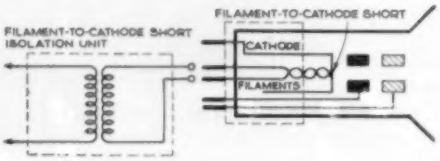
A COUPLE of months ago, a customer turned out to be my captain from Armed Service days, a chap for whom I harbor no love—to put it mildly. He was still in uniform.

He owned a 16-inch Emerson. His picture was too bright. He couldn't turn it down and the video detail was all washed out. I diagnosed it as a short between the filaments and the cathode of the picture tube.

In the crackling voice I remembered so well, the captain ordered me to change it. I informed him politely that he was

wrong. It didn't require replacement. It could be repaired. All I received for the explanation was a snort.

The only reason a cathode-to-filament short is bad in a picture tube is that the two elements are electrically fed from two different circuits that must never be joined. If the filament does manage to touch the cathode, it can be fixed by simply isolating one circuit from another and leaving the short be.



There is a little 1:1 transformer unit on the market that can isolate the filament circuit from the cathode circuit.* Called a cathode-ray-tube booster (isolation type), it looks like the filament boost unit and is installed in exactly the same way. I ignored the professional soldier's command to replace the picture tube and installed one of these little isolation jobs. The picture snapped back into gorgeous splendor.

My ex-captain didn't say anything. He just paid his bill and looked annoyed. But I guess he's not so bad, after all. In a short time I was flooded with TV service work from the nearby base.

*Supply shops that sell radio and television tubes will also sell you these transformers, or you can order from such mail-order houses as Allied Radio, 100 N. Western, Chicago; or Lafayette Radio, 100 Sixth Ave., NYC. The CRT booster transformer shown in the photo is made by Chicago Standard Transformer Corp., 3580 N. Elston, Chicago.

Cathode-to-Control-Grid Short

I FOUND another type of defunct picture tube in a tense situation. A 24-inch Westinghouse setting high on a taproom shelf had gone off duty. The screen was almost dark. Only very faint movement could be seen. The feature horse race from the local track was to start in about 20 minutes. A dark-haired bookie told me anxiously, "You get that thing working by post time and you got yourself a beautiful tip."

The trouble proved to be a cathode-to-grid short in the big tube. When the cathode ray leaves the cathode it passes through another element called the control grid. This grid has an electromagnetic representation of the picture issuing out of itself and puts these impulses into the cathode ray. The alterations in the cathode ray cause light spots and dark spots on the picture tube face. This is the viewing picture. This tube was defective because the control grid was shorting against the cathode.

Unfortunately, there is no isolation unit to remedy that, but there is an almost infallible trick to separate the two elements. For the grid itself does not actually do the shorting. Some flaking occurs on all the tube elements. These flakes bridge the tiny gap between the elements and cause the short. An isolation job consists of peeling these flakes out of the spaces between the two tube elements.

Here is how it's done:

I grounded the cathode pin with a connecting wire. Then I connected another lead to the plate of the horizontal output tube, which carries a 4,000-volt RF voltage. Taking the 4,000-volt probe, I tapped it to the control-grid pin. The 4,000 volts flew across the cathode-to-grid short. Once, twice and I was done. The RF voltage very neatly cleaned off all the flakes. The cathode-to-grid short was unshorted. The picture came on like new, sharp and crystal clear.

As I left the bar with an extra ten in my wallet, I could hear a bugle at the track blast out its TA-TAAA-TA-TA in glad fashion.

There are other ways in which a picture tube may go dead. Any of the grids or the cathode can open just as the filaments did in the dress shop. But they usually open between the plastic cap and the outside of the glass envelope. Here, too, the dripping-solder method will effect the repair.

There can also be what is known as a control-grid-to-accelerator short. After the cathode ray leaves the control grid it comes to another element that gives it an electromagnetic shove toward the luminous face. This element is called the accelerator. In cases of control-grid-to-accelerator short, the high RF voltage will turn the trick.

Naturally, some tubes have to be replaced. A filament voltage booster won't do any good if a tube is too far gone. Sometimes a short in the elements is welded tight and nothing helps. But these jobs are in the minority.

Open Element Inside the Glass

THE last and rarest type of cathode-ray-tube failure is ticklish to fix and has less than a 50-50 chance of success. I've run into only a few of them. One job in particular sticks in my mind because the set owner's thanks came in

such an unexpected—and unwanted—way.

I walked in on this job and found a bad picture tube in a 19-inch Admiral. There was good brightness on the screen but no video. I diagnosed the trouble as an open control grid. But instead of being outside the sealed glass, the break was inside the vacuumed envelope.

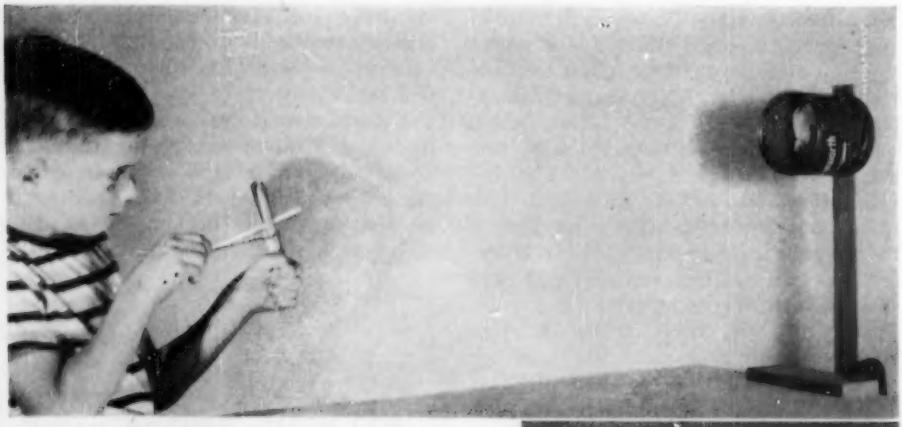
Service companies have a special instrument now called a picture-tube fixer. I hooked mine up to the bad cathode-ray tube and turned it on. The first thing the machine did was heat up the metal structures in the tube. Then when they were good and hot I pressed a button and an RF voltage shot through the elements. Simultaneously I tapped steadily on the CRT neck with a small screwdriver. Between the heat, the RF voltage and the vibration, sometimes the open parts of the element will touch. If they do, all of the energy going on welds them together once more. Sometimes it does and other times it doesn't. Luckily this time it did. The tube was resurrected. The picture came back on beautifully.

My client's eyes shone with delight. He clasped his hands together and told me in sonorous tones, "I am very pleased with the repair. If I can ever take care of you in the future I will be very happy to do so." He's a nice guy. I have nothing against him at all. But you know what he is? He's an undertaker. END

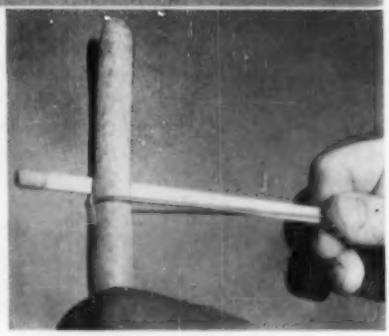
HINT TO AN UNHANDY HANDY MAN

It's a phrase often said
But forgotten by some:
"Hit the nail on the head,
Not the nail on the thumb."

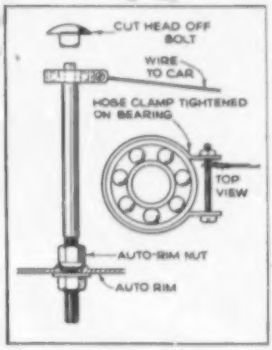
—BERTON BRALEY



Clothespin Shoots Arrows into a Tin-Can Target



A YOUNGSTER can while away many winter or rainy-day hours with this clothespin slingshot. Tape a rubber band around the clothespin just below the crotch. Whittle arrows from splinters of wood, gluing a piece of dowel to the leading end of each as a weight to keep it straight in flight. The target is a can on a stick. A wadded cloth in the bottom of the can will keep the arrows from bouncing out.—*Sam Grant, New York City.*



Car Wheel Serves as Kids' Race-Car Hub

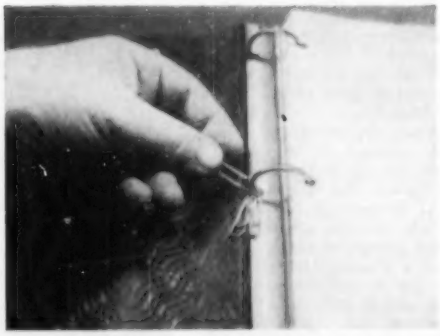
YOUNGSTERS can race their model cars against time around this durable center post—a bolt secured to an old auto wheel and tire. Use a bolt about 8″ long and cut off the head. The threaded end is held by means of two nuts and washers in one of the hub's lug holes, as in the drawing at right. On the other end of the bolt, file a collar to take a non-shielded ball bearing. Then fasten a hose clamp around the bearing and attach the guy wire to the clamp and bridle of the racer.

Old Tires Form Train Tunnels

A CHILD gets a big kick out of having lots of tunnels for his trains. You can cut them from a worn auto tire ready for the heap. Slice them off with a hacksaw.

Funny Picture Makes 'em Smile

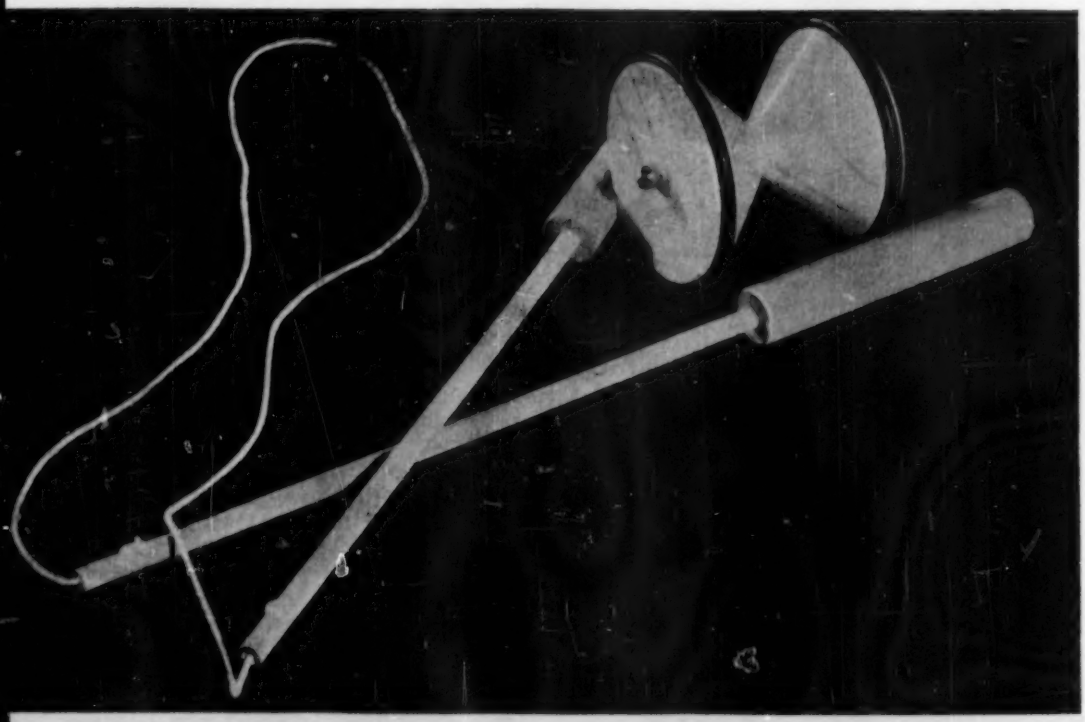
HAVE trouble getting your tot to smile for the camera? Mount a funny picture at eye level on the wall behind the photographer. The child will grin every time.



Binder Rings Hold Spare Clips

PAPER clips take up no additional space and can be kept handy if you slip them on the rings of a loose-leaf binder in which you carry school or business papers.

A Diabolo Is Fun to Make



TO SPIN THE TOP, you raise and lower the sticks alternately, with a quick backward shift of the string at the end of each rotating impulse.

When the speed is great enough to stabilize the top in flight, just whip the sticks apart to toss it into the air. As the spool comes down you catch it on a sloping string and let it roll down into slack bunched near one end.

Two diabolo twirlers can volley the spool between them; four can play a two-team game, racking points for longest volleys without a miss.

and Fly

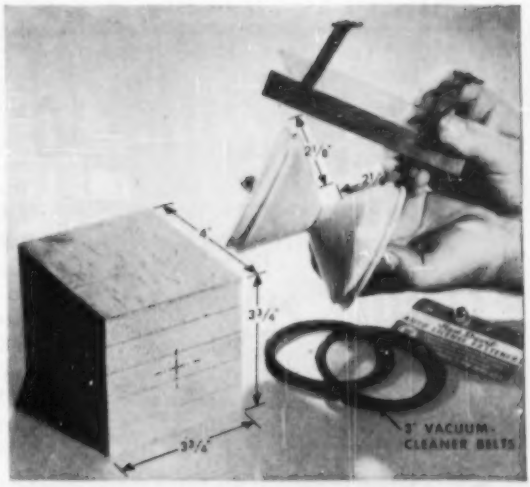
HERE is an unusual Christmas present for any youngster—a wasp-waisted diabolo top and the sticks and cord you need to spin and cast it high, wide and handsome through the air.

A game with a history, diabolo was popular with the ancient Chinese and with French sports of Napoleon's day before American youngsters turned it into a backyard fad from 1910 to 1915.

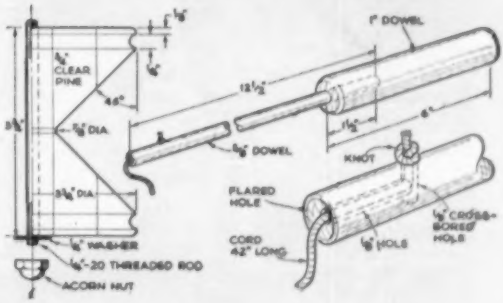
Considerably more skill is needed to twirl a diabolo top than the Yo-yo it resembles. The diabolo flies free and is caught before it falls to the ground.

The top shown here was patterned after an old-timer I found in an attic trunk. The 1956 model was made more stable by adding a balance-adjusting core, and easier on itself and indoor surroundings by placing rubber rings on the rims. These are 3″-diameter vacuum cleaner belts bought at a cleaner service shop. Acorn nuts, from a box of auto-license fasteners, cap the threaded core. To stabilize the top, you shift the threaded rod a bit to one side or the other with the nuts.

Rough out the spool with a skew chisel, finish with a V-point chisel. Face the ends close to the nuts on the mandrel. Chisel off the remainder. Glue ⅜″ dowels into 1″ dowel handles to make the sticks. Tie a 42″ length of chalk line or heavy fishline to each pair. Make at least two pairs.—*Stewart Rouse, Lewisville, Ind.*



THE DIABOLO BLANK is ¾″ wood glued up as above. Drill a ¼″ hole through the center and insert a threaded rod. Lock the rod in place with nuts and washers and, using the rod as a mandrel, set the blank between lathe centers. Check the turning with a template made by clamping a steel rule across the 90° angle of a draftsman's triangle. After turning ¼″ end grooves for the vacuum cleaner belts, remove the nuts, sand off the ends of the spool and apply two coats of shellac. Shorten the rod and thread on balance-adjusting acorn nuts.



Give small tykes a big lift with this

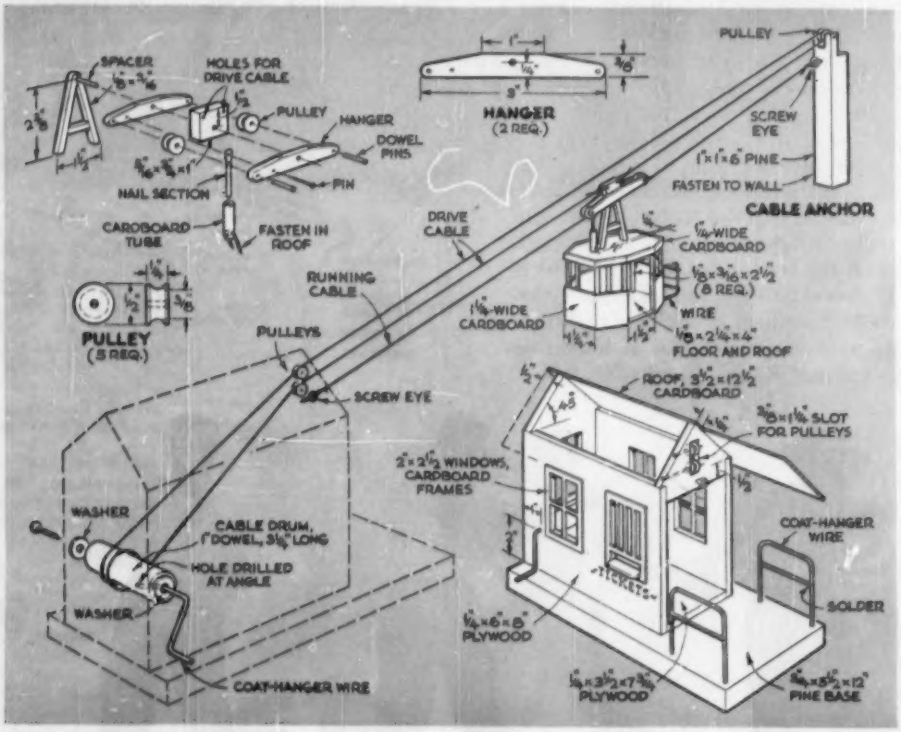
Aerial Tram

STRUNG in a stair well, this miniature aerial tram will give young operators as much of a thrill as a ride on a full-scale Swiss funicular car.

The driving mechanism is a hand-cranked drum in a winch-house made of plywood and cardboard, mounted on a heavy base to counteract cable tension.

The car, built of thin wood and Bristol board, under-rides a two-wheeled hanger, which angles with the incline of the cables. Turn the pulley wheels, along with those for the winch-house and return-cable anchor, from ½" doweling. To keep the car from rocking as the hanger tilts, flatten one end of a 1¾"-long rod cut from a nail, and drill a hole through it so that the rod can be hung from a pin between the hanger sides. Slipped into a Bristol-board sleeve stapled to the car roof, the rod acts as a sway damper.

Suspend the car from a running cable stretched between screw eyes on the winch-house and the return-cable anchor. Wrap the drive cable around the winch and carry the two ends over the pulleys under the gable. Attach one end to the car hanger. String the other end over the pulley on the return-cable anchor and then bring it back and attach it to the hanger.—*Roy L. Clough Jr.*



Is It Noise or Music?

With simple odds and ends and a small household motor, you can amuse a child and show him how notes are born.

By Andrew Pfeiffer

PRESSED by an inquisitive youngster to tell him what sound is made of, you need not flush and stammer. If you have an unbreakable 10″ phonograph record around the house—preferably one too scratched to bear replaying—some scrap wood, a bolt and some screws, a sheet of wrapping paper, an eye dropper and slim rubber tubing, and an electric drill press, you can appear as wise as a sage.

If the household goods do not include a drill press but do embrace an electric sewing machine, your position as local font of wisdom is still secure.

Now, it may be a commonplace to you that sound is made up of vibrations, and that irregular vibrations simply create noise whereas regular vibrations generate musical notes. But, however familiar the principle may be to you, how would you demonstrate it to a child?

Aha, we thought so!

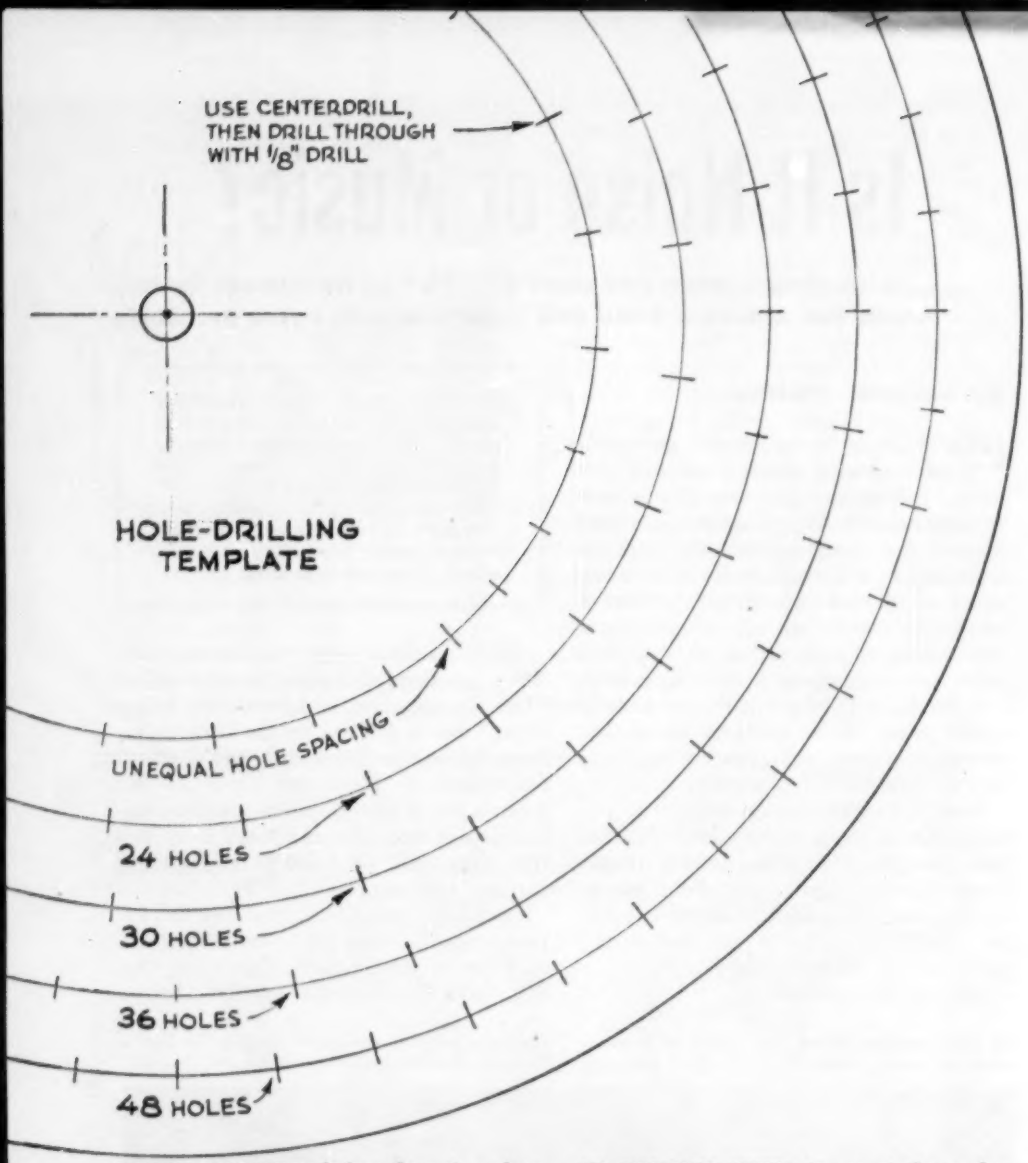
EDITOR'S NOTE: Science provides a fascinating bag of tricks from which, if you are prepared, you can pluck diverting and instructive answers to that familiar child's cry, "Daddy, what'll I do now?"

The tricks are simple laboratory demonstrations of natural laws. A monthly series, of which this is the first article, will show you how to do them.

Well, on these pages are the answers. They are derived from a booklet called "The Construction of Laboratory Apparatus," that is put out by the United Nations Educational, Scientific and Cultural Organization. They are intended for schools and training workshops in underdeveloped countries, but there is no law that says they can't be used for educational fun, too.

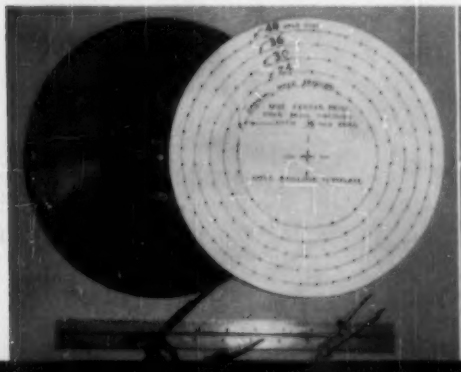
Spot holes on the record. For this experiment, you need five concentric rings of holes in your record. The outer ring is to have the most, the next ring fewer,

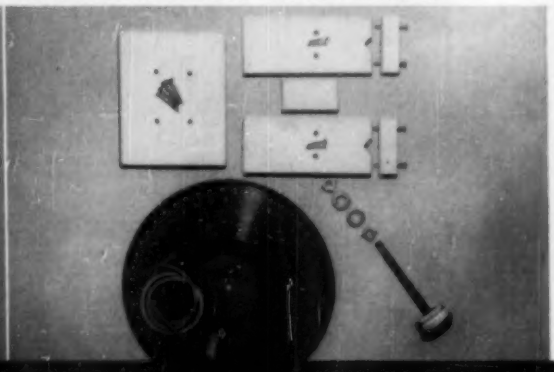
AS THIS RECORD SPINS, the holes in it make music or noise, depending on which ones are cutting across the stream of air that the boy is blowing. A sewing-machine motor runs this rig.



DRILLING TEMPLATE made from the pattern above is shown below, before it was rubber-cemented to the unbreakable record as a secure guide for drilling. The numbers on the template tell how many holes are in each concentric ring.

ALL MATERIALS NEEDED to mount the perforated record for a demonstration of how various sounds are created are laid out below. You make a two-bearing block from ¾" lumber or plywood, as in the drawing on facing page.





and up on to the innermost. The holes, however the distance between them changes, must be evenly spaced on all except the innermost ring. Here they must be spaced unevenly.

You need a template, which you can make by drawing circles on a smooth piece of wrapping paper and stepping off the holes with dividers. Or you can cut out the drawing on the facing page and use this to make your template.

Push a pin through the center of the drawing into the wrapping paper. With a divider point, prick through every hole on the drawing. Then shift the drawing until a pin stuck through an end hole will go through the last prick mark in that row on the template. Continue until all holes are spotted on the template.

Punch or cut out the center hole of the template truly. Then thread the template on a pencil and push the pencil point into the center hole of the record. Carefully done, this should center the template perfectly. Apply rubber cement to make it stick. Then with a sharp prick punch, awl or divider point, spot the holes on the record. Leave the template in place while you drill.

Start with a small drill. If you have a centerdrill such as is used for lathe work, start the holes with it. If not, use a No. 50, a $\frac{1}{16}''$ or similar small drill, chucked short so that it runs true.

After starting all the holes, change to a $\frac{1}{8}''$ drill and go through. Do not press too hard, especially when the point is about to break through the record. Should you crack the record, use another; a flawed disc could be dangerous.

Chopping air into sound. To run the siren disc on a drill press, mount it on a $\frac{5}{16}''$ bolt, using washers on both sides and a nut to clamp it tightly. Chuck the bolt shank, and you are in business. Now to show your youngster how different sounds are made.

Remove the bulb from an eye dropper and slip one end of a slim rubber tube over the glass in its place. Put the other end of the tube in your mouth.

Start the drill press at medium speed. Then hold the small end of the eye dropper over one row of holes on the spinning record and blow through the tube. You and the youngster will hear a clear tone.

Move the glass tip to any other row of holes except the inmost one, and you will hear another tone, at a different pitch.

Now hold the glass tip over the inmost row. Instead of a musical note, you'll hear a definitely nonmusical noise.

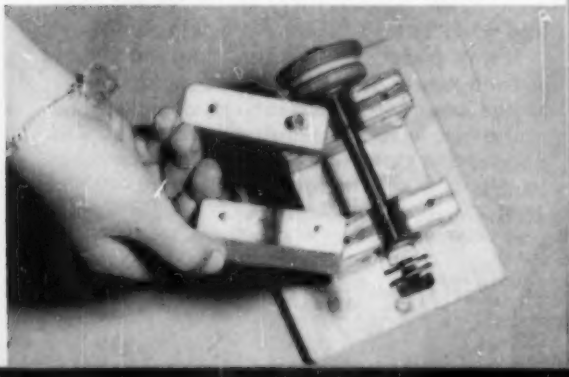
What makes music? The air stream passes through each hole in turn but is chopped off sharply between them. Evenly spaced holes interrupt it in perfect rhythm and result in a single note. The more often the stream is interrupted, the higher the pitch, or frequency. Therefore, at a constant speed, a circle with a lot of holes will produce a higher note than one with relatively few.

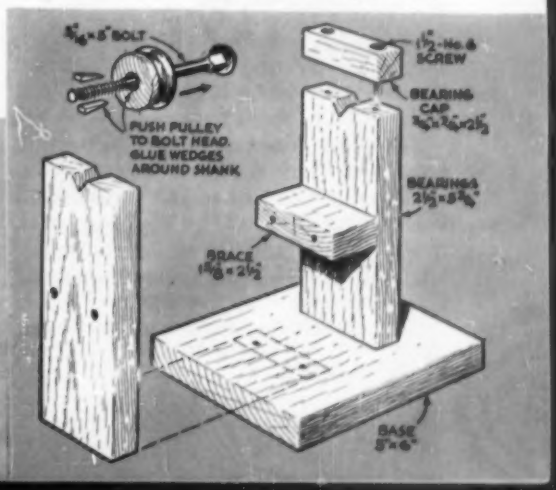
If you vary the speed, you vary the pitch. By turning the drill press on and off, you can make the pitch of any row of evenly spaced holes rise and fall with the characteristic wail of a police siren.

On the other hand, when you blow air through the eye dropper at the row of

[*Continued on page 236*]

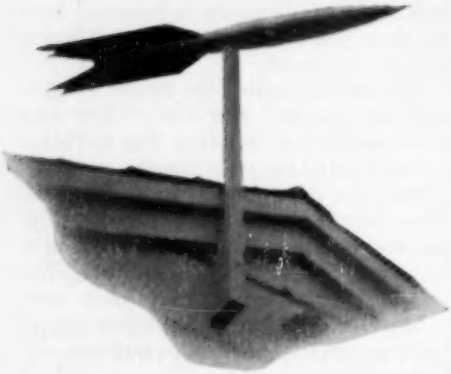
WITH THE SHAFT IN PLACE, tighten the bearing caps just enough to permit free running. If the axle has much shake, file down the bearing-block caps slightly. Lubricate the V notches and caps with a deposit of soft pencil lead.

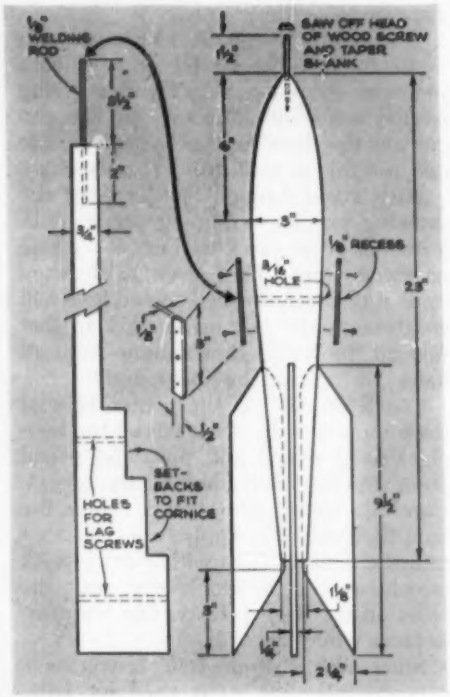


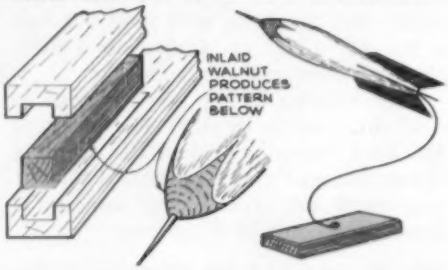


How to turn

A Rocket Weather Vane







YOU could call this turning project a two-stage rocket. In one stage it's a striking desk ornament. Or make it twice as big for an unusual weather vane.

For the weather vane, turn the body from a 23″ block of pine measuring at least 3″ by 3″ in cross section. Scribe centers on the ends. Drive a long wood screw into one end until only the unthreaded shank projects. Remove the screwhead and file to a point.

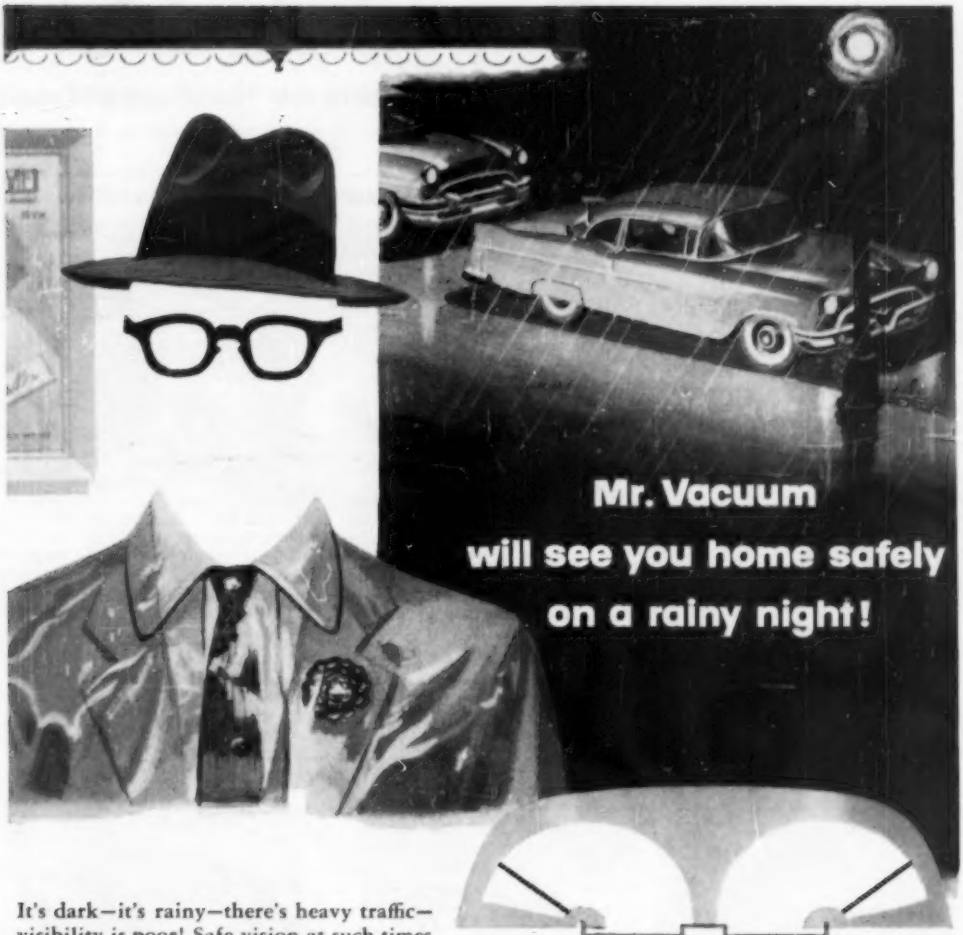
Turning the body. At the other end of the block, cut ¼″ grooves for the fins. Force bits of scrap into the grooves to prevent chipping. Use a chuck to grip the screw shank in the lathe while you turn and sand the rocket to contour. Then pry out the groove-filling stock. Cut the fins and glue them in position.

Balance the rocket on a pencil and bore a ⅛″ hole through it $\frac{1}{16}$″ ahead of the balance point. For bearing plates use ⅛″ flat steel stock. Bore a ⅛″ hole through the lower bearing plate and halfway through the upper bearing plate. Drill holes in both plates for wood screws.

Finishing touches. Align the bearing holes and mark the screw locations on the rocket. Then ream out the bearing hole in the rocket to $\frac{3}{16}$″ diameter, pack it with grease and screw on the plates. Give the rocket a coat of aluminum paint and accent the four fins with red paint.

Cut the weather-vane mast to match the contour of the fascia strip on your house or garage. Drill a ⅛″ hole for a welding-rod spindle, mount the rocket and stand by for a breeze.

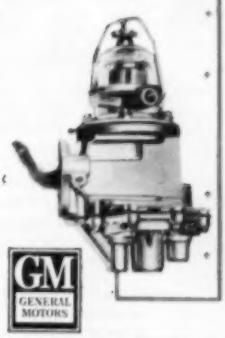
If you prefer the desk ornament, turn it from maple. A walnut block, inserted in the nose before turning, produces a vari-toned effect. The fins and base are also cut from walnut, and the connecting loop is a length of brass spring wire.—*H. R. Corry, Miles City, Mont.*



It's dark—it's rainy—there's heavy traffic—visibility is poor! Safe vision at such times depends upon strong, steady windshield wiper action to keep the obscuring rain cleared from the glass. That's when you need the help of Mr. Vacuum!

That's what an AC Combination Fuel and Vacuum Booster Pump provides. Perhaps your car has one—many cars do. If not—your AC dealer can easily replace your present fuel pump with this double-value, double-purpose AC product.

Safety is everybody's business. You'll drive under trying conditions more safely, more comfortably, and with less fatigue if you ride with Mr. Vacuum. It's the extra vacuum power that insures safer vision.



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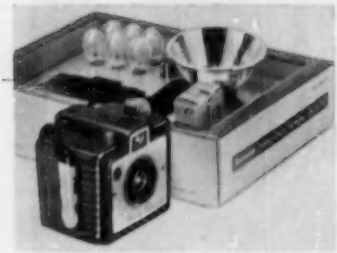
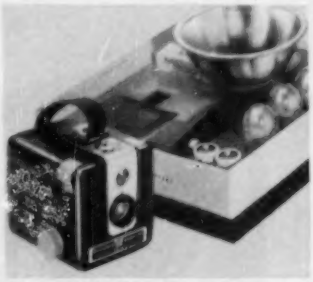
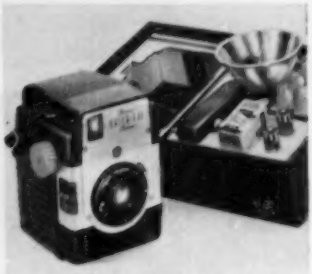


Ideal "first" outfit. Brownie Holiday Camera, flasholder, flashguard, batteries, bulbs, and film. Brownie Holiday Flash Outfit complete, **$9.75.** Camera alone, **$4.95**

Complete ready-to-use photo-flash gift outfits . . .



Brownie Hawkeye has no "settings" to adjust. Makes 12 snapshots per roll of color or black-and-white film indoors or out. Brownie Hawkeye Flash Outfit complete, **$14.35.** The camera alone, only **$7.45**



Brownie Bull's-Eye lens focuses to 4 feet for close-ups, adjusts by dial for snapping "groups" or "scenes." Other deluxe features. Brownie Bull's-Eye Flash Outfit complete, **$18.60.** The camera alone, only **$13.50**

Kodak Duaflex—"Preview-Finder" lets you see pictures before you shoot. Kodak Duaflex Flash Outfit complete, only **$21.75.** Duaflex Kodet Camera alone, **$14.95** (brown-finish camera slightly higher). A Deluxe Duaflex *f*/8 Camera and Flash Outfit are also available.

Deluxe Kodak Gift Kits for Color-Slide Fans . . .

An all-time color-slide favorite, the versatile Kodak Pony 135, Model C, features a fast *f*/3.5 lens, 1/300 shutter. Kodak Pony 135 Outfit (camera, flasholder, case) **$49.65.** The camera alone, **$33.75**

Kodak Bantam RF takes Kodacolor snaps as well as full-color slides. Fine rangefinder, *f*/3.9 lens, 1/300 shutter. Kodak Town-and-Country Outfit (camera, flasholder, case) **$65.45.** Kodak Bantam RF Camera alone, only **$49.75**

Kodak's Signet 35 features a matchless Ektar *f*/3.5 Lens, coupled rangefinder, 1/300 shutter, precision controls. Kodak Signet 35 Outfit (camera, flasholder, case) **$91.45.** The camera alone, only **$75**

Kodak Stereo Camera for 3-D color-slides. Twin *f*/3.5 lenses, 1/200 shutter. Kodak Stereo Outfit (camera, Stereo Viewer I) **$97.25.** Camera alone, **$84.50.** Stereo Viewer I, **$12.75;** Viewer II, **$23.75**

Kodak gift for everyone

finish happily at your Kodak dealer's

(Ask him about small down payments, easy terms)

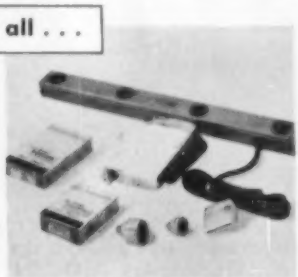
New Do-It-Yourself Photo-Hobby Outfits

It's easy to develop negatives and print snapshots at home with a Kodak Photo-Hobby Outfit. There are two *complete* "do-it-yourself" Outfits to choose from—alike except for the snapshot printer they feature and the amount of chemicals and printing paper they contain. Each comes with an 11 x 14-inch card (above) which explains the simple steps for developing and printing. Kodak Deluxe Photo-Hobby Outfit, **$16.95.** Regular Photo-Hobby Outfit, **$9.95.** The Kodak Deluxe Photo-Hobby Printer alone, only **$7.95**

Home Movies—the finest family gift of them all . . .

Brownie Movie Kit with a 4-Lamp Movie Light (lamps extra) to provide plenty of light for indoor color movies. Brownie Movie Kit with *f*/2.7 lens, **$49.95.** Brownie Movie Kit with fast *f*/1.9 lens, **$59.20**

Complete movie-making outfit. To *make* color movies, a Brownie Movie Camera, *f*/2.7 lens. To *show* them, a Brownie Movie Projector with an *f*/1.6 lens, *plus* a preview screen. Brownie Movie Outfit complete, **$99.50**



Welcome gifts for movie-makers. Brownie 4-Lamp Movie Light, **$8.45.** Kodak Converters for 8mm Brownie Movie Cameras, Wide angle, Telephoto, **$18.50** ea. Kodachrome Movie Film, from **$3.75**

Kodak Photo "Stocking Gifts" for Everybody

Film—buy it in thrifty Kodak Duo-Paks, one roll for the camera, another for a spare. Popular sizes of black-and-white, from **75¢.** Kodacolor, from **$1.70.** For color-slide fans—Kodaslide Dial-Lite Viewer, **$12.95;** Kodaslide Pocket Viewer, **$1.95.** Books for fact hunters —"How To Make Good Pictures," **$1;** "How To Make Good Movies," **$2;** Kodak Photoguides, **$1.75** ea. Many other gifts to choose from.

Prices are list, include Federal tax where applicable, and are subject to change without notice

Eastman Kodak Company, Rochester 4, N.Y.

How to Build a Wobble Sander

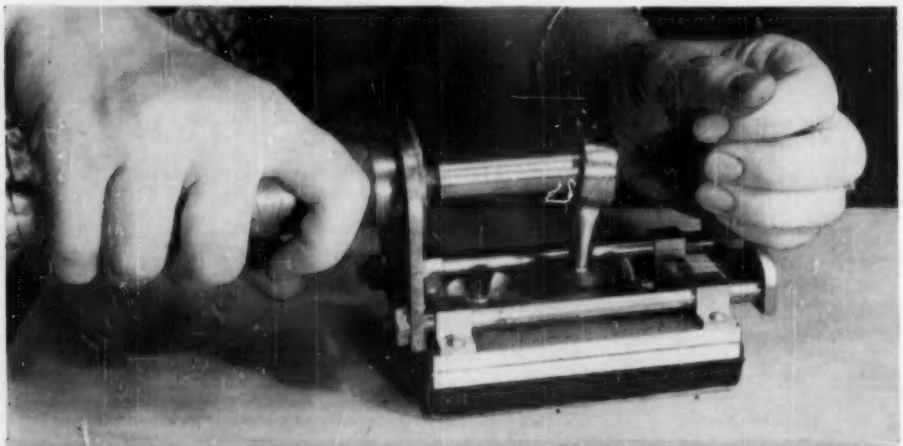
You just guide it on the work. Its own weight, and power supplied by a flexible shaft, will smooth yards of wood with little effort.

By Richard C. Decker

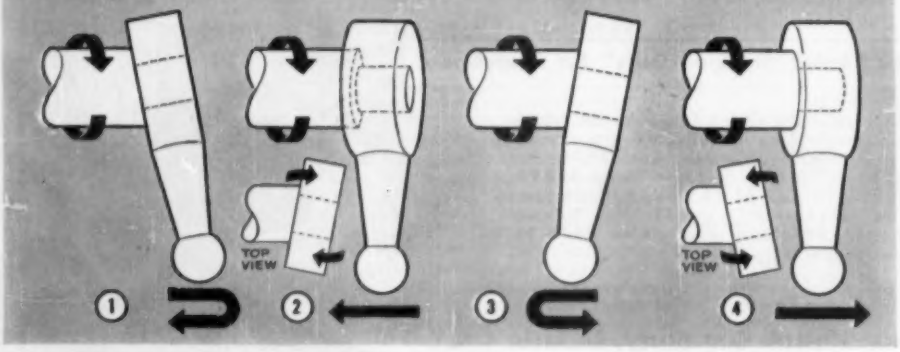
A POWER sander like this, driven by a flexible shaft on a ⅓-hp. motor, makes quick work of sanding table tops, floors and other broad surfaces. The action of the wobble arm moves the sanding plate back and forth 3,450 times per minute.

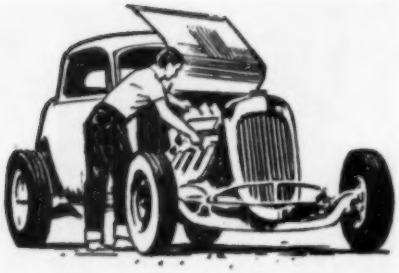
Cut two 3"-by-4½" plates from ¼" aluminum. Clamp them together and drill No. 7 holes through both. Tap the holes in the sole plate ½"-20 and enlarge the holes in the upper slide plate to ¼". Turn

[*Continued on page 222*]



WOBBLING LIKE A WHEEL ON A BENT AXLE, the eccentric arm drives the sanding plate forward and back in a straight line. In the drawing below, when the offset stub is "bent" upward (1), the arm has completed a stroke and moves as follows: as the stub rotates a quarter turn (2), the arm swings back one-half stroke and twists slightly; in the bent-down position (3), it has completed one full stroke back and is about to start forward; in another quarter turn (4), it moves forward one-half stroke and twists in the opposite direction, untwisting again as the stub bends up to complete the cycle.





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[*Continued from page 220*]

the wobble-arm well from 1½″-diameter drill rod and rivet it in position on the slide plate. Make two slide rods from ⅜″ drill rod. Thread one end of each $\frac{5}{16}$″-18 and turn a short $\frac{5}{16}$″ shoulder on the other end. Make four slide bearings from chunks of ⅜″ brass, and rivet them to the slide plate, using the slide rods to align them. Cut the front and back end plates from 3/16″ flat steel. Fasten the front plate to the slide rods by peening-over the shouldered ends of the rods. Secure the backplate to the rods with two $\frac{5}{16}$″ nuts and lock washers.

Making the wobble arm. Rough-shape the wobble arm from a flat piece of ½″ cold-rolled steel. File the outer diameter of the bearing housing smooth and round, chuck it in a lathe and bore a force-fit hole for the bearing.

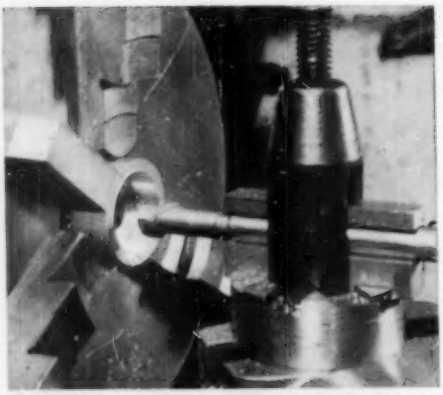
Centerdrill both ends of the wobble arm, mount it between centers and drive it with a C clamp dogged to the faceplate. Turn the taper on the arm, and shoulder the bottom end to fit a ¼″ hole drilled through a steel ball. Mount the ball on the shoulder and peen the end.

How to make it wobble. Lay out and punch centers on the wobble shaft as shown in the drawing on page 224, and turn the offset stub end to a force fit in the wobble-arm bearing. The centers must be laid out accurately, or up-and-down motion of the arm will result.

Mount the shaft next in the chuck, and drill and thread to match the threads on the end of your flexible shaft.

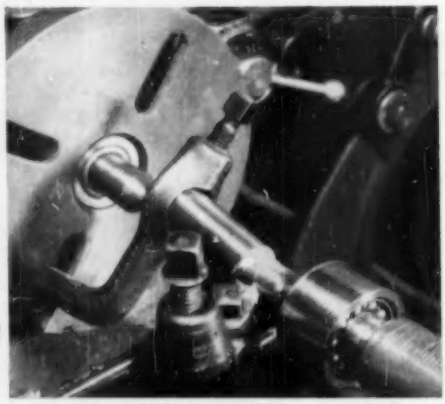
Up until now, the construction is the same regardless of the type of flexible shaft you own, but you'll have to fit the sleeve on the backplate to your particular shaft. The one shown was threaded and riveted to the backplate so that the threaded collar on a Montgomery Ward shaft could be used to fasten the shaft to the sander. If your shaft has no collar, a setscrew can be installed in the sleeve to hold the flexible-shaft handle in place. In any case, the shaft must be mounted accurately in line with the center of the bearing in the wobble arm.

[*Continued on page 224*]



CHUCK ROUGHED-OUT WOBBLE ARM in lathe and bore a force-fit hole to take ball bearing.

MOUNT ON CENTERS and drive with a C-clamp dog to taper the shank and shoulder the end.



WITH THE WOBBLE-ARM SHAFT mounted off center, machine the eccentric end to fit in bearing.

Texaco Tips On Car Care

← Safety check your heater hose connections

If the rubber tubing between your heater and motor block is weak, it may break and splash your engine with the coolant and anti-freeze. Carefully inspect these hose connections. Interior linings on hoses three or four years old may have separated and the entire connection should be replaced. You'll find your heater will work better, too. Your nearby Texaco Dealer has a stock of new tubing on hand.

Safeguard your chassis with proper lubrication

Marfak chassis lubrication protects your car against winter weather. It's tough and stretchy . . . clings tightly to points of wear and friction . . . won't squeeze out, jar out or wash out. So you get smooth, *cushiony* motoring for 1,000 miles or more. And remember — your car is lubricated by chart, not by chance. Today, drive in for longer lasting *Marfak* chassis lubrication. See your Texaco Dealer, *the best friend your car has ever had.*

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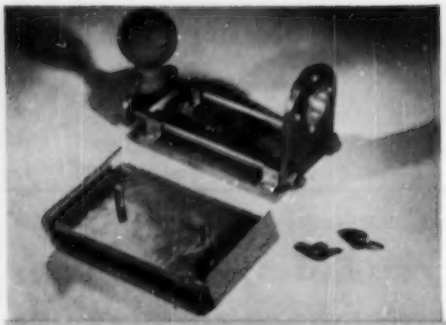
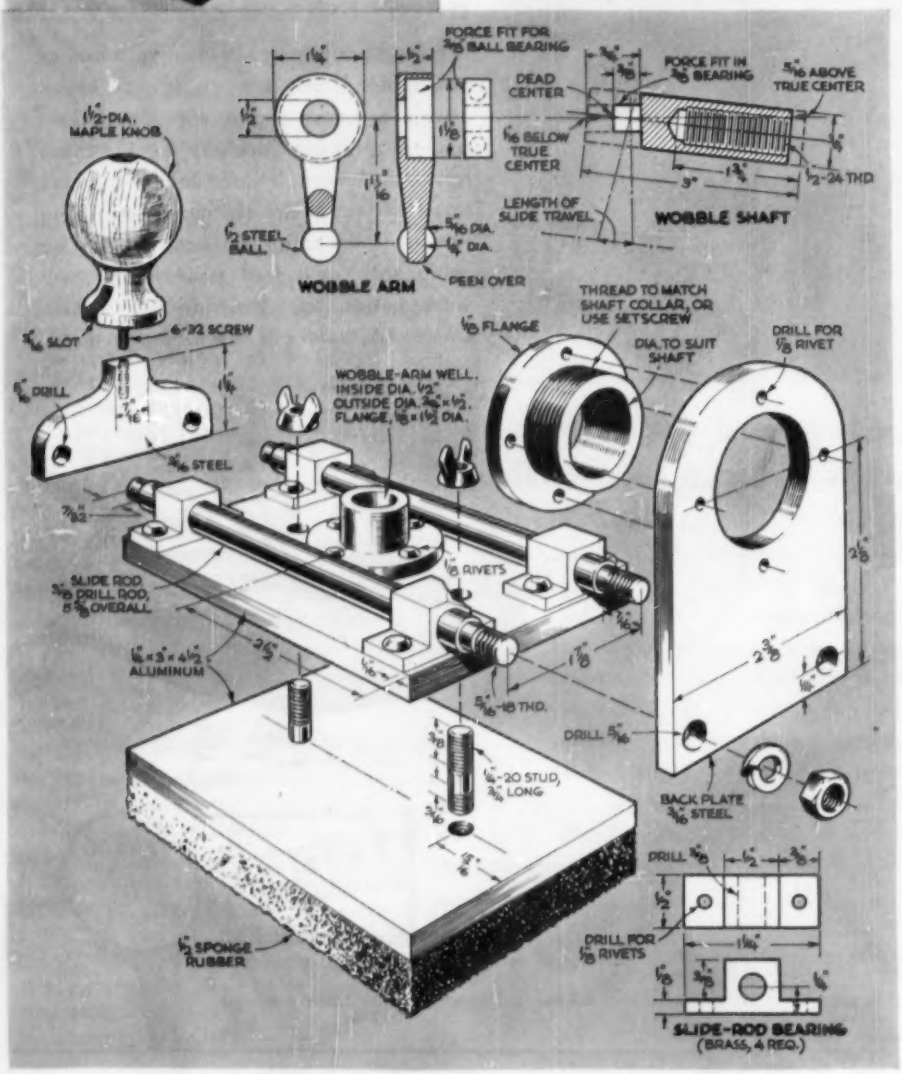


[*Continued from page 222*]

To attach sandpaper, loosen the two wing nuts, fold the paper over the ends of the sole plate, and tighten again to clamp the ends between the plates. Use open-coat aluminum oxide paper.

Lubricate the rods and their four bearings with light oil and put cup grease in the wobble-arm well. END

TO USE SANDPAPER, clamp it between the sole and slide plates, lock it in with the wing nuts.



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Day and night, for 14 gruelling non-stop days, this new 1956 Dodge Custom Royal 4-Door Sedan shattered all American stock car records in the unlimited closed car division for every distance up to 31,224 miles. A. C. Pillsbury, AAA official in charge, wired, "This amazing performance demonstrates the great power and rugged endurance of your fine new product." No specially equipped or "souped-up" car, this new champion was *selected at random* from the Dodge production line by AAA officials. It's the *same* car you yourself can buy today, powered by our new 230 horsepower V-8 engine.

Here's how the records fell to the dynamic new '56 Dodge!

- All-time AAA record of 92.86 mph for 14 days.
- Every AAA American and International performance and endurance record for American closed cars up to 31,224 miles.
- 27 World's Unlimited Records.
- Every International Class B record from 4,000 through 31,224 miles.
- Total of 306 records in all.
- New AAA record 114.05 mph for flying-start mile.
- New AAA record 79.55 mph for standing-start mile.

Plenty of style too! The lady in your life will go for the dramatic new Jet-Fin styling, the "Panel-Perfect" Jacquard fabrics, the Magic Touch push-button driving.

Don't buy any '56 car until you see and drive the **New '56 DODGE**

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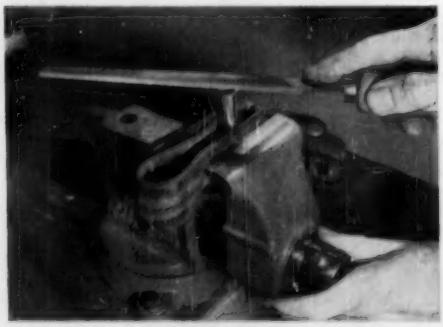
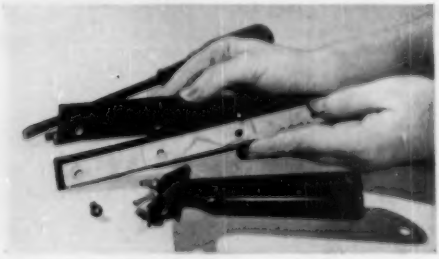
Wallpaper Seals Xmas Gifts

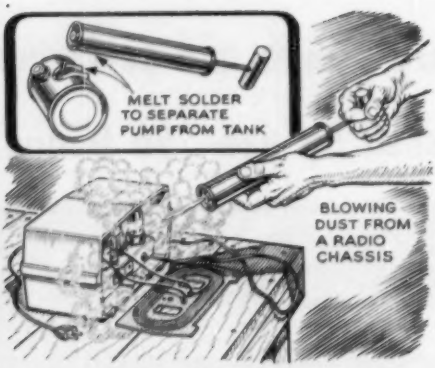
PREPASTED wallpaper cut into strips makes handsome tape for sealing Christmas packages. Just moisten the paste side with a sponge and stick it around the package.



Belting Protects Work in Vise

YOU can prevent damage to tubing or metal rod by padding the jaws of a vise with a piece of rubber or leather belting folded as above.—*Walter E. Burton, Akron, Ohio.*





Fly Gun Blows Away Dust

DUST accumulations in a radio chassis or other hard-to-reach places can be blown out with puffs from an old insecticide sprayer. —*William S. Hart, North Royalton, Ohio.*

Eraser Cleans Rust Off Tools

NEED an abrasive for removing light rust on small tools? Try the coarser end of an ordinary ink eraser.—*Frank Shore, NYC.*

Jar Holds Pencil Shavings

ADD a de luxe touch—a shavings reservoir—to your dime-store pencil sharpener by cementing it to the cover of a plastic cheese container. Cut away the plastic under the sharpener when the cement is dry.

Squeegee Leads a Double Life

A RUBBER squeegee blade can be used twice as long if you reverse it—as shown at the left—when one side becomes dull. You'll find the unused back edge sharp and square.

Gas mileage stretches out to a happy *maximum* when you install a Rochester Carburetor! Rochester does the perfect fueling job smoothly and efficiently, year after dependable year! That's why fuel's no stranger in *this* paradise! Cadillac, Buick, Oldsmobile, Pontiac and Chevrolet . . . *they depend on Rochesters!* Relax—get a Rochester on the job for you, today!

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DELTA SHOP

Famous one-motor combination of full-size power tools

It's a Saw It's a Jointer It's a Drill Press It's a Sander

The ONLY right combination of basic power tools. The U. S. Chamber of Commerce says this about multipurpose tools: "The machine which is used most should be the basis of this tool . . ."

The DeltaShop is built around the Circular Saw—the basic, most-used woodworking tool. It also includes the full-size Delta Homecraft Jointer, Drill Press, and Sander. *Not* a collection of attachments, but a combination of real Delta Quality Power Tools operated on one motor.

Exclusive "Tool-at-a-time" Plan makes it easy to own. The DeltaShop is the *only* combination tool you can buy "a-tool-at-a-time," as your budget permits.

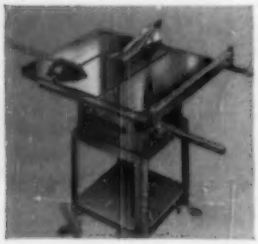
See the Exclusive Delta Saber Saw Attachment: Makes *curve* cutting machines of both the DeltaShop and the Delta 8" Tilting Arbor Saw! Unlimited capacity for internal and external curved work.

Individual Tools or All-Purpose Combination?

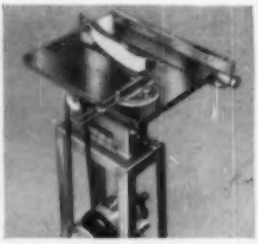
Which is best for *you?* Only you can decide that—after you have weighed the facts about your workshop space, the kind of work you want to do, and the condition of your pocketbook. But your Delta Dealer can help with *impartial* facts because Delta, oldest and largest power tool producer, makes *both* combination *and* individual tools to suit every need and budget.

Are All Power Tools Equally Accurate, Rugged?

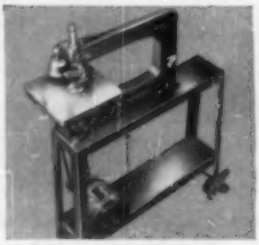
No, no more than all cars, TV sets or washing machines are equally good. The precision, economy, and fun you get *out* of a power tool depend on the skill, experience, and craftsmanship the *builder* puts *into* it. For many years, Delta Power Tools have set the standards of quality —and true economy—in thousands of industrial plants, school shops, and finest home workshops.



Delta **Homecraft 8" Tilt Arbor Saw:** The finest made for home shop use. Also available are Delta 10" and 12" tilting arbor saws.



Delta **Homecraft 8" Tilt Table Saw:** Gives you big saw results at small saw cost. Also available: Delta 10" tilting table saw.



Delta **Homecraft 16" Scroll Saw:** Rugged enough for Dad—safe enough for the children. Also larger 24" scroll saw available.

Delta **Homecraft 11" Wood Lathe:** Turns beautiful forms in wood, plastics, light metals. Delta 12" 4 and 16-speed models available.

DELTA ROCKWELL **world's most complete line of power tools**

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53 MACHINES . . . 246 MODELS . . . OVER 1300 ACCESSORIES

UP YOUR OWN MIND

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Are Power Tool Accessories Important?

Very—because the right accessories can almost double the usefulness of many power tools, at extremely low cost. And because Delta's 1300 accessories are designed as part of the world's most complete power tool family, many of them can be used with *several* tools. That's an added advantage you get from the "first family" of power tools.

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Some brands are sold largely on price—but buying on price alone can be a very expensive "economy," if you don't get *value* for what you spend. Delta makes tools in several price ranges; which is best for you only *you* can decide. But of this you can be sure: any Delta Power Tool in any price range represents a real bargain *value!*

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You'll find your Delta Dealer listed under "TOOLS" in the yellow pages of your telephone book, or you can see Delta Homecraft Tools at leading hardware and department stores. Send coupon for free fact book.

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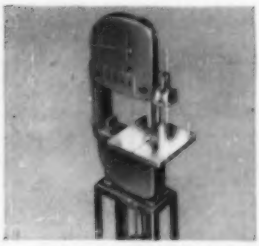
Delta **Homecraft 4" Jointer:** You get many built-in quality features found in larger Delta jointers—at exceptionally low cost.

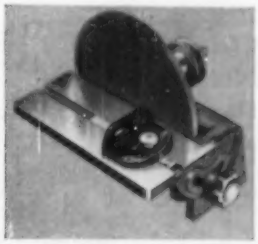
Delta **Homecraft Saw-Jointer:** Combines 8" circular saw and 4" jointer on one stand with one motor. Larger model available.

Delta **Homecraft 11" Drill Press:** Do countless jobs with this multi-purpose tool. Delta 14" and 17" models also available.



Delta **Homecraft 10" Band Saw:** Curved and straight line cutting even in hardwood. Delta 14" Band Saw also available.

Delta **Homecraft High Speed Shaper:** Makes smooth, professional-looking shaped edges. Larger shaper also available.



Delta **Homecraft 8½" Disc Sander:** Finishes wood, plastics, ivory, non-ferrous metals satin smooth. Larger model available.

Delta **Homecraft General Purpose Grinder:** Sharpens, buffs, polishes—has many other uses. A sensational value at its low price.

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- ☐ Please send me names of Delta Dealers nearest me.
- ☐ Please send catalog of Delta literature on power tools, plans, and projects.

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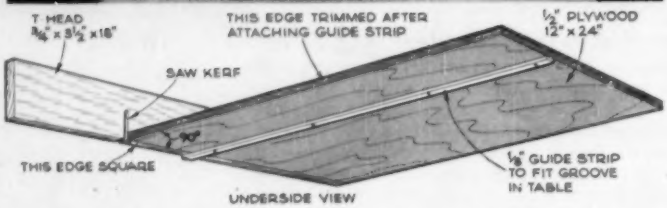
Jig Carries Wide Board Across Saw as You Make a Cut

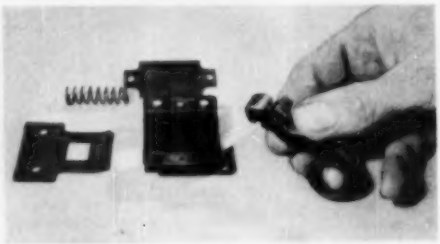


A REGULAR miter gauge is often inadequate for guiding wide boards when cross cutting. This jig provides a wide head for squaring the work and it actually carries the board across the saw table, preventing it from sliding sideways or running askew during the cut.

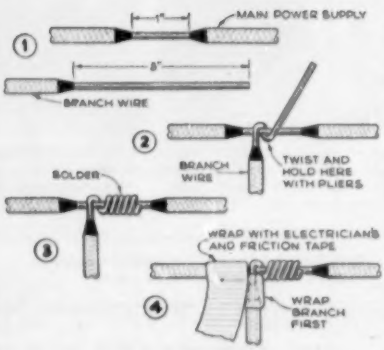
Select a flat piece of ½" plywood and glue a guide strip to its underside to run in the saw-table groove. Trim the right edge of the plywood by running it through the saw with the guide strip in the groove. Cut the trailing edge square to this edge and screw a straight board to it for the T head. In use, line the work up with the edge of the jig, press it firmly against the T head and then simply slide the improvised jig across the table.—*A. T. Halbing, Waterbury, Conn.*

Two-Slope Catch Is Automatic

A CUPBOARD latch becomes a friction catch—a simple movement of the door will open or close it—if you cut a second slope on the end of the bolt. Shape the slope so that the bolt slides in and out of the striker plate when the door is moved in either direction. A little car-door lubricant will help.—*Walter E. Burton, Akron, Ohio.*



ELECTRICAL, BRANCH SPLICE



THE branch, or tap, splice is used to make a connection to a main power wire. In making this or other splices, cut the insulation at an angle at the points where it is removed.

After flowing solder on the twist for a good electrical contact, wrap the splice with tape, beginning with the branch and then covering the bare section of the main power line. Build up an insulating covering with electrician's tape, stretching and overlapping it until the covering is at least as thick as the original insulation. Then cover this with one or two layers of ordinary friction tape.

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE.

Finest drill of its type. Drills 1" holes in wood, ¼" in metal—and sands, polishes, removes paint. **No. 1814 Drill** with Jacobs Geared Key Chuck . . . **$25.70**

New self-powered Orbital Sander will sand in any direction without tracking, scoring or burning. **No. 580 Orbital Sander,** regular $44.95 value. **Special for Christmas** . . **$39.95**

Fastest-cutting jig saw made

Actually 6 saws in one. Cuts wood, plastic, metal; cuts own starting hole in wood. **No. 480 Jig Saw** with 4 assorted blades, regular $44.95 value, **Special for Christmas** . . **$39.95**

There's something Wonderful here FOR EVERY MAN ON YOUR LIST!

START A COMPLETE POWER WORKSHOP WITH THIS

4.0 amp. ⅓ h.p. 888 POWER UNIT

The Gift that keeps growing! This husky Power Unit comes completely equipped as a ⅜" drill, 6" sander and polisher. The inexpensive but beautifully engineered attachments listed below can be added any time to make a complete Power Workshop.

Special for Christmas . . . **$39.95** Regular $44.95

with Jacobs Geared Key Chuck

TO MAKE IT EASY FOR YOU

Add these for a fraction of the cost of individually powered tools

"Dyno-Mite" Power Workshop You — or the lucky recipient — can convert the sensational **888 Power Unit** to a whole workshop of power tools by adding these specially designed inexpensive attachments — including a 6" Portable Circular Saw, an Orbital Sander, a Portable or Bench Jig Saw, a Bench Sander, Bench Grinder, 6¼" Circular Bench Saw, and a Drill Press. Ask your dealer to show them to you.

Your dealer now has a special group of Millers Falls Tools in Xmas packages. And ask him for the special Millers Falls Xmas folders. Or write us direct.

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FINEST POWER TOOLS MADE

Gus Plays a Double Role

[Continued from page 152]

"Ho, ho," Gus roared jovially, slapping Stan so enthusiastically on the back that he staggered. "And how are my reindeer, my good lad?"

WITH tools in hand, Gus racked his memory for the details of the heating unit as he had gone over them at the time of purchase. He checked the high-tension ignition points, took out the tiny, high-pressure oil-spray nozzle and cleaned it, the children gleefully following his every move. He experimentally turned the heat-limit control switch from "automatic" setting to "manual." The hot-air fan started.

"Santa's fixed it," the children cried in unison.

Gus beamed on them, even though he knew that by starting the fan manually he had merely sent a current of air upstairs from a cold and flameless burner. He turned the switch back to automatic control. He now inspected the primary control switch, which was mounted in the furnace stack. This, he recalled, was primarily a safety device, with a heat-controlled bimetallic coil. It was so constructed that it would turn off the burner within a minute or so after it started to run if the burner didn't ignite in that time to bring heat to the stack. Gus noted that the re-set button on this switch was out. A crafty look came into his eyes as he pressed the re-set button.

The burner whirred, but without flame. It ran a minute or more and stopped.

Aha, Gus thought, he had either ignition trouble or no oil at the burner. Now at least he knew where to start. The ignition points seemed all right—he'd bet this rig was out of fuel.

"You, there," he bellowed, pointing a finger at Sam Howard. "Have you got fuel in your tanks?"

"Of course I have," Sam said. "In fact, the left-hand tank is full."

There went another theory, Gus thought grimly.

"I know the left-hand tank's full," Sam went on, "because I turned off the right-hand tank a couple hours ago when it ran dry, and turned on the left, which ain't had a drop used out of it since it was filled. It holds nigh on to 600 gallons."

"So," Gus breathed, forgetting for the first time to use his Santa Claus voice, "the right-hand tank ran dry, did it, and you turned on the left."

"Maybe Santa can't fix our fire," a small voice—Ann Trotter's—said.

"He can, too," Tommy Willard said stoutly. "Santa can fix anything. Can't you, Santa?"

"Well," Gus said thoughtfully, stroking his beard, a twinkle in his eyes, "I haven't got all my magic tools from the North Pole. But if I had a plain, ordinary tin can, I just might do the trick that I have in mind."

"Tin can!" sputtered Matt Bergstrom, who had just come into the basement. "Tin can! Find him one, Sam."

SAM found a tin can that had once held liquid soap. Gus put it beneath the burner-regulating valve and backed off the bleeder plug. He pressed the re-set button on the primary switch. As the burner ran, it pumped out some oil—and along with the oil, the air lock that had been created when the right-hand fuel tank ran dry, and the left-hand fuel was forced in upon it.

Gus shut off the bleeder plug before the burner stopped. He waited a couple of minutes and then pressed the re-set switch again. This time when the burner started Gus heard the roar of flame in the furnace pot, felt the swelling of heat.

"Santa fixed it, Santa fixed it!" the children cried, dancing around Gus.

Standing there, Gus lifted his eyes and sent up his own private, Christmas Eve prayer of thanks that as an automobile mechanic he had known all about air locks in fuel lines. END

NEXT MONTH: Gus follows a cold clue.

The hot one's even hotter!

'56 Chevrolet

THE BEL AIR SPORT SEDAN—one of two new 4-door hardtops.

It's the new 1956 Chevrolet—with bold new Motoramic styling . . . frisky new models . . . and more of the dynamic action that's zoomed its way into America's heart!

They're here—and even *hotter!* That's the word on the new '56 Chevrolets.

They offer new higher horsepower—ranging up to a top of 205! This is the car, you know, that smashed the Pikes Peak record! That's *proof* of the kind of performance that puts more safety and fun in your driving.

And look at that sassy new Motoramic styling—the lower, longer hood, the bold new front-end and sweeping chrome. See the new flaired fender openings and high-fashion taillights. (The left-side taillight hides the gas cap!)

The fun's at your Chevrolet dealer's. So, why wait? . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

The new "Two-Ten" 2-door Sedan

The new 9-passenger Bel Air Beauville

The new Bel Air Convertible

This is "Myth" —comes in several colors.

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Easier to work in!

Your wife's kitchen is her "workshop." That's where she proudly exhibits her cooking skill. If she could only be rid of the cleaning-up afterwards!

You can put *your* skill to work and reduce her cleaning of work-surfaces to next-to-nothing . . . by installing St. Regis Panelyte. This smooth, hard surface goes on easily, over the sink, counter and tables.

Your wife will find that it resists all stains from foods, spilled liquids, boiling water, grease.

Patterns are modern, colors lovely. "Easy to Apply" St. Regis Panelyte comes in a special 1/10" thickness you can work with simple hand tools or 1/16" thickness used with Panelyte contact adhesive.

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First Aid for Universal Motors

[Continued from page 173]

drill housing itself grounded by this wire, you'd get no shock, only a blown fuse."

"So how come I got one?" asked Bud.

"That is a stickler, isn't it? You think about it. Then we'll talk again."

As Bud left, Cam looked at the drill closely, grinned, and continued assembling my motor. Then he plugged it in.

It roared enthusiastically. "Sounds better than it ever did," I yelled.

Cam nodded, snapped it off.

"It'll do," he said, as Bud came over again. "Figured it out, Bud?"

"No-o. How could I have got a shock from the case when it was grounded, unless I was touching something hot?"

"You're getting warm," said Cam. "Matter of fact, you were. And you're the only one of us who could have. Here—grab the drill as if you're using it."

Mystified, Bud did so.

"Now look under your first finger."

Bud lifted it off the drill. As he stared, a grin spread over his face.

"What do you know? I'll have to tape that up until I can get a new one."

I'd had enough mystery. "Let's see."

The hot spot. Bud turned the drill toward me. "See that brush cap? I must have broken the insulation off it last time I put it back. The juice went through my finger, through my hand to the housing, and back by the ground lead to the meter."

"But the broken brush cap was the villain, not the ground lead," Cam pointed out. "Every electric tool should have such a lead. Just fasten a single wire under a bolt on some unpainted spot, tape it to the cord, and put on an alligator clip."

"Okay. But why is Bud the only one who could have touched this bare cap?"

"Oh, that—because it's the brush on the left side of the drill, and he's the only one of us who's left-handed. There's where he had it all over us in finding what was wrong."

"I did?" asked Bud innocently.

"Sure. Who else," asked Cam, with a wink at me, "could have put his finger right on the trouble?" END

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*Orders must be received by Dec. 31, 1953, good U.S.A. only.

Is It Noise or Music?

[*Continued from page 215*]

unevenly spaced holes, the air is chopped off irregularly, resulting in mere noise.

Rig a motor drive. If you do not have a drill press, you can drive the perforated record from any small motor. A sewing-machine motor is especially suitable.

For this, mount the disc on a shaft running in its own bearings. The drawing on page 215 shows how to do it.

Cut off ¾" from one end of a wooden spool 1½" in diameter. If you have an electric drill, mount this piece on a $\frac{5}{16}$" bolt and chuck the shank. With the drill

> ***The one part of the human anatomy that continues to grow after 21 is the wishbone.***
>
> —THE SIDEWALK SUPERINTENDENT

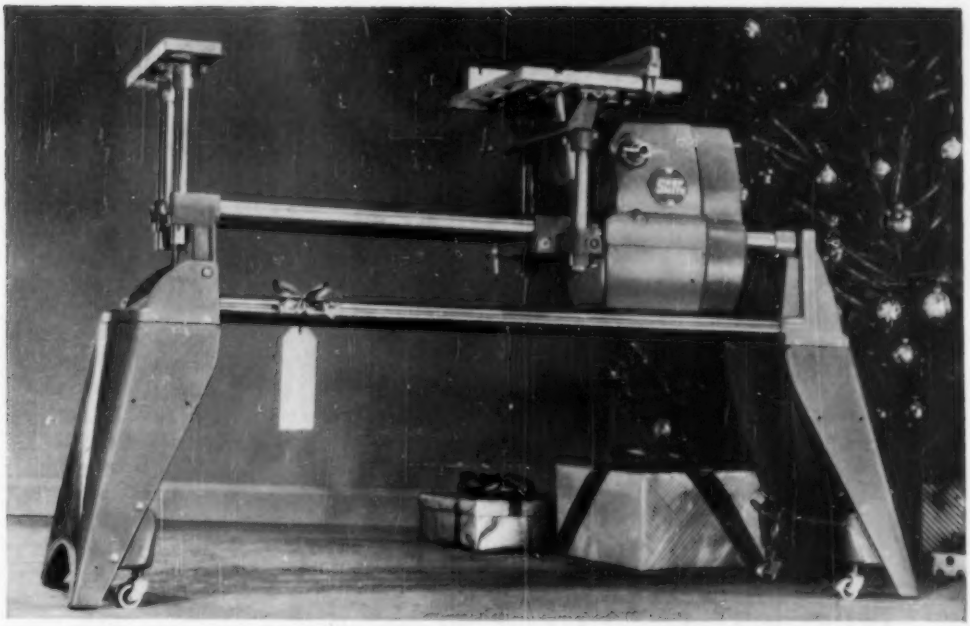
running, hold a rat-tail file against the spool edge to form a groove for the sewing-machine belt. If you have no drill, wrap two lengths of tape around the spool with a gap to form the groove.

Press the spool onto the squared section of a $\frac{5}{16}$" carriage bolt 5" long. Drive small wooden wedges between the bolt and the spool to center the latter. Slide on another washer or two, set the shaft into the bearings and run a nut up to the washers. If end play is excessive, insert more washers as required.

Put another washer outside the nut, screw the record on (the hole may be tight on the threads) and clamp it with another washer and nut. After lubricating the bearing caps, tighten them just enough to let the shaft run without slackness or binding. If the disc does not run true, insert cardboard shims.

Clamp or screw the bearing base to a flat surface and align the sewing-machine pulley with that of the disc. Use the sewing-machine belt to drive the rig.

Since your record will revolve at high speed, stand well out of line with it when it is spinning fast. And don't touch! You may be burned if you do, and the unmusical sound that follows will come from you and not from the record. END



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SHOPSMITH

This present has a future! SHOPSMITH® will give years of fun and work-saving service in your home.

In one magnificent machine you get a saw, disc sander, vertical and horizontal drill, lathe. Motor is ¾ hp. and built in. Speed-Dial lets you choose *any* speed from 700 to 5200 rpm. SHOPSMITH'S twin-tube, fast-coupling Power-Mount lets you add jointer, jigsaw, and sprayer.

Make sure your Santa sees SHOPSMITH at your leading hardware or department store or any Montgomery Ward store. Place SHOPSMITH under your tree for as little as $3 per week. SHOPSMITH can earn back every penny of it!

In vertical drilling—or any other operation—SHOPSMITH is accurate and foolproof. No job too big . . . none too exacting. Takes up no more space than a bicycle.

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"This stuff can RUIN your car engine!"

Road dust, hard carbon and sludge can cost you plenty—if your oil filter is clogged

In 4000 miles your filter traps up to 3 pounds of abrasives and sludge . . . gets so clogged it can't stop more of this destructive grit from damaging costly engine parts. You need a new Purolator® Oil Filter! Up to 10 times more effective than ordinary filters, Purolator keeps your engine running cleaner, smoother, *longer*. Ask your serviceman to install a new Purolator Micronic® Refill *every 4000 miles*. Takes only minutes. From $1.60.

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9 out of 10 NASCAR racing drivers use

PurOlator

America's No.1 Oil Filter

America's Favorite Christmas Windows

[*Continued from page 112*]

It is doubtful that even a persistent follower of animated cartoons has seen animals doing all that these do, and the most observant naturalist has never reported such scenes. Beside a blazing fire, a possum works a bellows while a rabbit and raccoon warm paws and a skunk toasts his tail. A rabbit tosses salad, a raccoon and a squirrel consume sundaes and a raccoon cuts a cake.

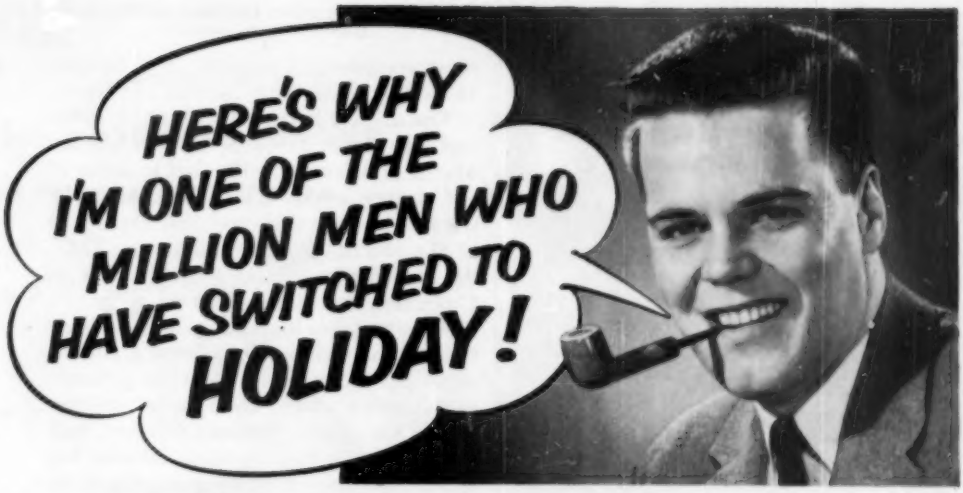
A nine-inch frog—Silvestri's smallest moving character—touches his foot to ice on a pond, and withdraws it quickly. A turtle, a raccoon and a bear cub (on his tummy, kicking) gaze at fish swimming in the pond. An elf pulls a baby rabbit out of a brook. A possum skates, as do a raccoon, skunk, frog and turtle. A deer flicks at a snowflake on its nose. A baby raccoon and a squirrel make a snow bunny. A long line of animals coasts down a hillside on toboggans, sleds, bellies and tail bones. And there is an animal band.

Silvestri's animal kingdom may be seen at, among other stores, Altman's in New York City, the O'Neil Co. in Akron, Kauffman's in Pittsburgh, Goldblatt's in Chicago, and the Boston Store in Milwaukee. It had a public preview recently at Filene's in Boston.

The Christmas Story. As told this year by Silvestri, the Nativity becomes a four-minute play, with words and music on tape synchronized with movements of the characters. A curtain across the window goes up. The Wise Men, shepherds and sheep march across the window, turn around and face a stage. Then a curtain on the stage rises to show Mary, Joseph and the Holy Child. The Star of Bethlehem meanwhile has grown brighter (by means of slowly opening shutters). The curtains fall. In a two-minute intermission, the characters back off, ready to begin again.

Small motors control the curtains and, by pulling chains under a slotted floor, move the characters. Spotlights go on and off to light the show. It's Silvestri's

[*Continued on page 240*]



Only HOLIDAY gives you this Custom Blend for Mildness!

Yes, five famous tobaccos skillfully blended into a mixture of unequalled flavor, aroma and mildness. These fine tobaccos, selected from all parts of the world, are blended with a base of cool-smoking white burley . . . Each tobacco adds its own distinctive flavor and aroma to make Holiday America's finest pipe mixture. We suggest you try a pipeful . . . enjoy its coolness, flavor and aroma . . . and see for yourself why more and more men who smoke mixtures are switching to Holiday as a steady smoke.

These are the five famous tobaccos which give Holiday its mildness and aroma.

HOLIDAY gives you this Heat-Sealed Wrap-Around Pouch!

Holiday tobacco leaves our blending line with just the right moisture content. And it stays that way because Holiday is the only mixture which has the Wrap-Around pouch. Sealed air-and-water tight, it guarantees you a fresher, cooler-smoking tobacco.

AT YOUR DEALER'S

IF YOU PREFER A BLEND OF STRAIGHT BURLEYS

Try Edgeworth—choice cool-smoking white burleys in the air-tight pouch. America's finest pipe tobacco.

Get this guaranteed "Olde London" Pipe and two full-size pouches of Holiday tobacco for only $1.00. The pipe is fine, hand-rubbed imported briar . . . with genuine hard rubber bit . . . carbonized bowl for cooler smoking. If your dealer is unable to supply you, use this handy order blank.

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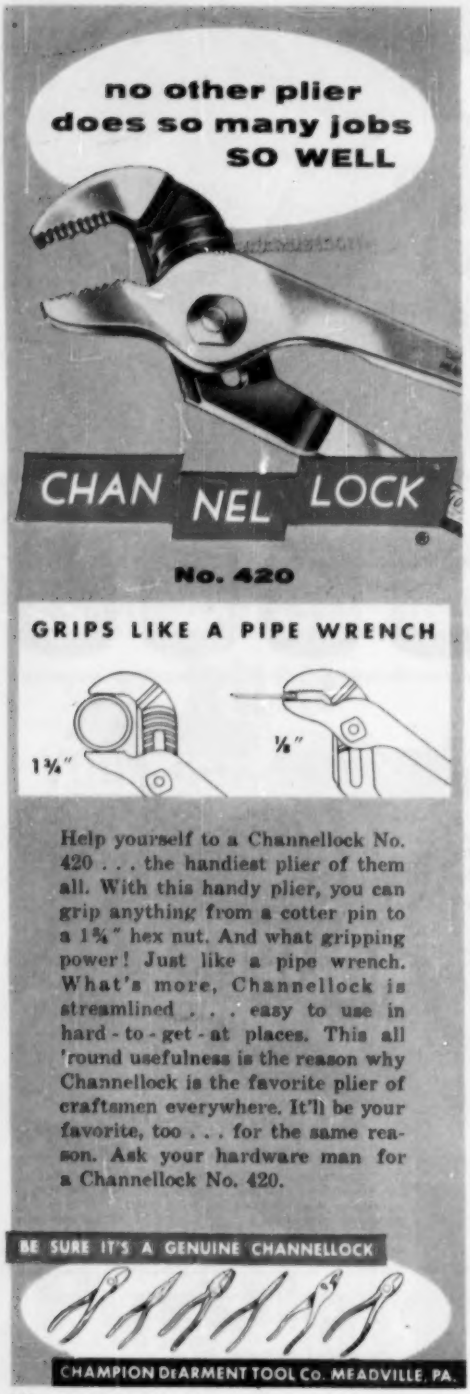
Mail with $1.00 to "Olde London," Larus & Brother Company, Inc., Richmond, Va.
Offer Good Only in U. S. A. PS-12



America's Favorite Christmas Windows
[*Continued from page 238*]

most complicated window, and he provides one of his own men to operate it.

The display is eight feet high, 12 wide and five deep. It costs $12,950. Jordan Marsh of Miami was the first to order it.

Country store. This one has to be seen to be believed, and you can see it at the Hecht Co. in Washington, D.C., the Eaton Co. in Toronto, Shillito's in Cincinnati and other stores.

Silvestri takes his ideas where he finds them. Last year someone sent a Christmas card picturing an old-time general-merchandise store to Eunice Milton, one of his artists. She sold Silvestri, and the result is a country-store interior big enough for you to walk into, or it can be split into units for several windows.

People have been walking through it. Silvestri's Chicago studio is open to the public. A mother, taking her children through his country store, saw a boy swiping cookies from a bin. "I told you," she said sharply, "not to do that. I'll spank . . ." Her voice trailed off: the boy was one of Silvestri's animated figures.

In this display a five-foot Santa—Silvestri's tallest animated doll—waits on a customer, talks to a girl, and has his young assistant, Sam, show her toys. The boy brings out a toy—a bird that moves and pecks. The girl, pleased, checks a name off her list as her dog barks and wags his tail with delight.

That's just part of the activity in this country store, which probably is busier than any such store ever was. A girl cranks an old-fashioned phone. A waitress brings sundaes to a boy and girl at a table. A boy points to candy, and a clerk weighs it out for him.

Silvestri's basic mechanism, used for all his moving dolls, is a fleapower electric motor. Usually it is under the floor, in a platform on which a doll stands, or (as in the case of the girl at the country-store phone) inside the phone box or other object. The tiny motor turns a camshaft, operating levers that move arms, legs, heads, and bodies of the dolls.

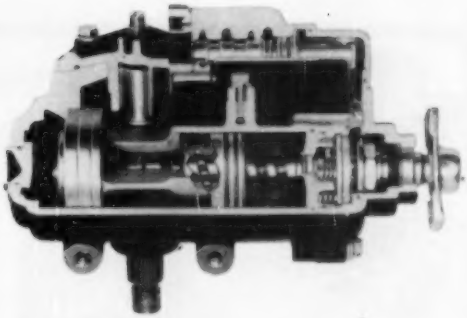
[*Continued on page 242*]

GM GENERAL MOTORS

ANNOUNCES

THE WORLD'S FINEST

STEERING SYSTEM



new Safety POWER STEERING

by Saginaw

WITH 3 MAJOR IMPROVEMENTS FOR 1956 !

1 TWICE-AS-EASY PARKING. Revolutionary new valve design cuts maximum manual effort in half. It never exceeds 5 lbs.

2 GREATER ROAD STABILITY. New system helps hold car "on course"—assures even more secure "road feel" than ever.

3 RELAXING NEW RESPONSE. Lower-ratio wheel responds more effortlessly—reduces mental and physical fatigue.

NEW "FROM THE GROUND UP"

A completely redesigned, simplified In-Line system with only 49 parts and basic improvements in steering geometry beginning right at the front wheels. Every part has been specifically engineered for *power* steering.

AUTOMATICALLY HELPS HOLD CAR "ON COURSE"—*Precision pre-load* built into ball-nut-and-worm assembly helps keep wheels centered straight ahead.

AUTOMATICALLY LIMITS MANUAL EFFORT WHILE PARKING. New *reaction-limiting valve* cuts in whenever turning resistance reaches predetermined point; increases power assistance to lower manual effort.

MAIL COUPON TODAY FOR FREE BOOKLET!

Saginaw Steering Gear Div
General Motors Corporation
Saginaw, Michigan (Dept 36C)

Please send free facts booklet on your NEW Safety Power Steering System

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

with the delicate appetite

under the hood of your car

IT'S A

CARTER

POWER CENTER

4-BARREL CARBURETER

When you drive at slow speeds, two of the barrels remain closed. But, when you "step down" for added power, all four barrels open to feed your car engine the proper mixture of fuel for full horsepower.

This amazing 4-Barrel Carbureter is an example of CARTER pioneering to give you more power from modern engines and modern fuels. You can keep this power like new for years by having your car regularly serviced wherever you see this sign,

or look under CARBURETER in the classified section of your phone book.

CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
Division of ACF INDUSTRIES, INCORPORATED

America's Favorite Christmas Windows

[Continued from page 240]

There is, however, Silvestri discovered to his sorrow, such a thing as too much motion. His principal character last Christmas was Wee Willie Winkie, who ran around windows, waving his arms, and told children (other animated dolls) that Santa Claus was coming.

Wee Willie, all through the holiday season, kept running his legs off and waving his arms off—a dismaying sight to honored customers (average age seven) of stores from coast to coast. Silvestri's men had their hands full trying to put Wee Willie together again.

To create his figures, Silvestri employs Guido Rabechini, a 62-year-old Italian sculptor whose work includes a frieze at Notre Dame Cathedral in Montreal. Rabechini makes moving statues of plaster, rubber, papier-mâché or excelsior.

Other materials that go into a Silvestri window are legion: spun glass (for angel hair), flock (finely chopped silk and rayon sprayed on as snow), fluorescent satin, ribbons of all widths and colors, kitten cloth (artificial fur), bunny fur (fur but not necessarily rabbit), tree lights (some the size of your little fingernail), manzanita trees, paint, varnish, shellac, cornstarch (in plaster), pipe cleaners, bottle caps, real cookies. He uses Christmas rope by the mile.

> ***All it takes to make a good idea generate steam is a person who can get all worked up over it.***
>
> —THE SIDEWALK SUPERINTENDENT

You might expect Christmas at home with his wife, Dorothy, and their three boys, to be on a colossal scale. It is not.

"I feel Christmasy in June," Silvestri confides, "when the year's displays are finished—not in December. By then, I'm a little tired of Christmas."

So on Christmas Eve he trims an ordinary tree in the ordinary way and, he admits, has as much trouble bracing the tree and getting decorations and lights to hang right as you do. END

A STANLEY CHRISTMAS means A Happy New Year

GIVE ACCURACY. It pays to be precise and say Stanley — it's a *good* rule. Here's why: a 6 ft. folding wood rule with extension slide, *No. X227 — $2.49;* and an 8 ft. Pull-Push steel tape rule in free magnifying lens box, *No. 1208W — $1.19.*

GIVE SMACKING SATISFACTION. This Stanley hammer is a handsome and perfectly balanced tool. The selected white hickory handle *absorbs* impact shock . . . keeps it away from your hand. *16 oz. No. N51-1/2 — $3.50.*

Hammers, rules and many other Stanley Tools for Christmas are now at your hardware store with special free Christmas stocking gift wrapping.

GIVE POWER FOR DRILLING AND DRIVING. Here's a work-saving combination. The ¼" electric drill is still the most popular power tool. *Stanley H41 Electric Drill — $27.95.* And the power screw driver with snap-in bits, *Stanley H180 Screw Driver Attachment — $6.95.*

GIVE POWER FOR SAWING. This portable electric saw makes clean, accurate cutting quick and easy. 6" blade cuts up to 2 inches at 90 degrees, 1½ inches at 45 degrees. "Motor Saver" feature protects against impact loads. Safe, sure and fast. *Stanley Builders Saw H65 — $67.50.*

STANLEY

The Stanley Works • New Britain, Conn.

TOOLS • ELECTRIC TOOLS
HARDWARE • STEEL • STEEL STRAPPING

DEPARTMENT TE, THE STANLEY WORKS,
63D Elm Street, New Britain, Conn.

Gentlemen: Please send me

☐ free Tool Catalog 55
☐ free Electric Tool Catalog E15
☐ 25¢ Pocket book – "How to Work With Tools and Wood" — I enclose 25¢.

Name _____

Address _____

City _____ Zone ____ State ____

Do-It-Yourself Jewelry Is Booming
[*Continued from page 117*]

engineer to teach jewelry-making. At the end of 18 months, Lloyd gave up contracting and joined Florence on a full-time basis.

Doctors, tool-and-die makers, gardeners, housewives, nurses, farmers, lawyers, children—in the ratio of five men to four women—have come to the Underwoods' Belmont Lapidary Supply for information and instruction.

A carpenter hit pay dirt, too. Bob Smith of Burlingame appeared at the shop one night and simply said, "I want to look for a rock." The Underwoods showed him how and where. He then took courses in lapidary work.

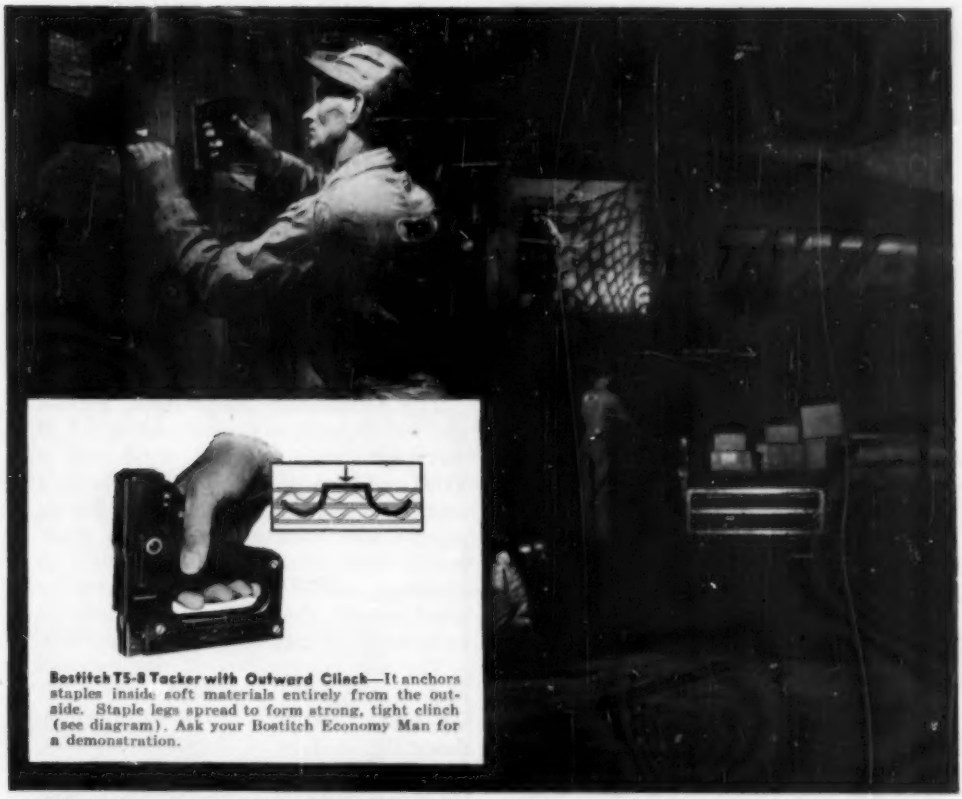
Two weeks after he had finished the courses, Bob brought the Underwoods

The trouble with silver linings is that they're no substitute for cold cash.
—THE SIDEWALK SUPERINTENDENT

a dozen pieces of jewelry that he had created. They were so well made and unusual in design that Lloyd and Florence assured him that he could sell them. He did. Then he started making cuff links and soon left carpentry behind. He now markets 100 to 200 pairs of cuff links a month at 25 men's stores.

It's not expensive. Lloyd points out that a beginner at the hobby can get along nicely with equipment costing between $40 and $50. That would give you a diamond saw, coarse and fine grinding wheels, and sanding and polishing disks, all of four-inch diameter. A seasoned lapidary would want a nine-inch diamond saw, with a vise for slicing two- or three-inch slabs of rock, and eight-inch grinding and polishing disks. Such an outfit costs around $200. For really fine jewelry, he'd add a faceting outfit, an additional $150 to $200.

Raw materials? Well, if you find them for yourself on the beach or along a river or near an abandoned mine, there's only the expense of gasoline and your time, happily spent. END



Bostitch T5-8 Tacker with Outward Clinch—It anchors staples inside soft materials entirely from the outside. Staple legs spread to form strong, tight clinch (see diagram). Ask your Bostitch Economy Man for a demonstration.

STAPLES HOLD BETTER AT ONE-TENTH THE COST! Trans World Airlines overlook no detail in assuring the safe, swift arrival of air freight shipments. Shipping bills fastened to cartons with even the best tape sometimes tore loose in damp climates. And taping cost $14 per thousand bills, not counting time taken to apply.

A Bostitch Economy Man suggested stapling the bills with a new Bostitch tacker that "spread-eagles" staple legs inside carton walls. TWA tried it, found stapling four times faster than taping and *far superior in holding power*. Cost: $1.40 a thousand. Now all major TWA stations are Bostitch-equipped.

How much can you save by switching to Bostitch stapling?

Your Bostitch Economy Man can tell you. He's one of 350 trained fastening specialists working out of 123 cities in the U. S. and Canada. There are over 800 kinds of Bostitch staplers in his cost-cutting repertoire. Look up "Bostitch" in your telephone directory, or check the coupon at the right.

Fasten it better and faster with

BOSTITCH
STAPLERS AND STAPLES

BOSTITCH, Inc., 572 Mechanic St., Westerly, R. I.
I'd like to know exactly how stapling can cut costs in our fastening operations. I'm particularly interested in the applications checked below:

HI-SPEED PRODUCTION FASTENING
- ☐ stapling vs. riveting
- ☐ stapling vs. spot welding
- ☐ stapling vs. screws or bolts
- ☐ stapling vs. glue or cement
- ☐ stapling vs. tape
- ☐ stapling vs. tacks or nails
- ☐ stapling vs. solder
- ☐ stapling vs. wire or string

PACKAGING and CARDING
- ☐ sealing bags (cloth, paper or plastic)
- ☐ mounting products on display cards
- ☐ fastening items to individual cards

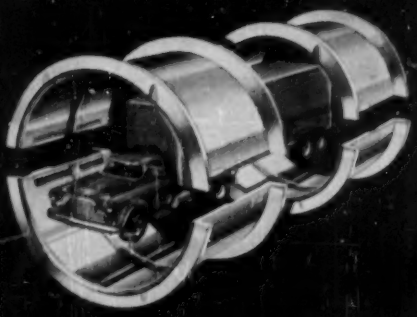
SHIPPING ROOM ECONOMIES
- ☐ preparing cartons for filling
- ☐ sealing filled cartons
- ☐ lining or padding crates
- ☐ applying shipping bills or tags

BUILDING APPLICATIONS
- ☐ applying asphalt roofing
- ☐ laying underfelt
- ☐ installing ceiling tile
- ☐ applying insulation
- ☐ installing low-voltage wiring
- ☐ applying shake shingle siding

OFFICE EFFICIENCIES
- ☐ filing
- ☐ routing
- ☐ posting
- ☐ binding folders and reports
- ☐ preparing advertising dummies

*Name*_____ *Position*_____
*Company*_____
*Address*_____
*City*_____ *Zone*_____ *State*_____

As many as 14 different metals and alloys are used to produce bearings for the light, medium and heavy-duty engines that power today's trucks. These specially-made bearings assure fine performance under the extremes of load, temperature, speed that are met in truck operation.



FEDERAL-MOGUL BEARINGS . . .

A Control Factor in Performance

Trucking service is the "professional" test for every automotive part. Engine bearings, for example, have to take the day-and-night pounding of highway hauling and city delivery. Bearings carry the engine load . . . meter the lubricating oil. They must give maximum mileage, to make payloads *really* pay! Modern precision bearings answer these demands with two to five times the mileage of the bearings of only 15 years ago.

Federal-Mogul bearings are preferred by the big truck and bus fleets, for bearing replacement, by 2 to 1. Replace with Federal-Mogul oil-control bearings to renew engine power and pick-up. They are engineered for the job!

for New Power . . .
FEDERAL-MOGUL
Oil-Control Bearings

RESEARCH • DESIGN • METALLURGY
PRECISION MANUFACTURING • SERVICE

You'll Hardly Know Studebaker
[Continued from page 138]

has to change plugs on a Golden Hawk fitted with power steering and power brakes will get a workout.

Hot Hawk. Shoehorning the Packard-built mill between the wheel housings may have been a mean job—the engineers beat their foreheads at the recollection—but the result is real lurid. There was only one hand-built car in existence at South Bend last August, and this writer got his hands on it only after promising to stay under 75 and, in proving-ground lingo, "to drive as though you owned it."

The Ultramatic transmission hushes any vulgar rubbery shrieks on take-off. If you *must* attract attention, wind it up to 3,000 and then pull the lever to Drive, a procedure that causes the rear tires to squawl like Shostakovich played backward. With four men, 200 pounds in sandbags and 50 pounds of photo equipment aboard, the G-Hawk easily climbs to 60 true (64 indicated) in 10.3 seconds.

The acceleration is most impressive at highway speeds; the problem after passing someone is to keep from storming down the road at an appalling velocity. The new high-capacity brakes drag the car down quick and straight. These new brakes, also used on the Presidents, have three times the fade resistance of their predecessors.

The future. Studebaker's full '56 line, in which Champions and Commanders count for more than the gilded G-Hawks, is closely integrated this year with its corporate relative (Packard). A full array ranging from the Champion six to the Packard Caribbean is lining up to do battle with the big boys. This marks a definite change. In the past, Studebaker was content to target on the "something-different" market; this year, they propose to fight it out across the board.

A lot of people wish them luck. END

Spaceship Ahoy!

Two space satellites were zipping around the earth in their orbits. One radioed over to the other, "Are you manned or MOUSE?"

Gifts from SKIL...for You Mean Christmas all year long for the family!

Famous SKIL Tools help you build for your family. Power-plus and professional features let you handle big jobs in the home. Build a rumpus room! Fix the stairs! Make a cabinet! Finish the basement! SKIL Tools let you give your family *more!* Here are Christmas gifts for you that mean *family fun all year long.*

32-PIECE SKIL DRILL KIT
Model 515 . . . Only $39.95.

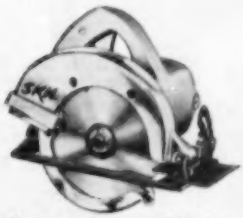
A whole workshop in one handy kit! 32 great tools including a powerful ¼" SKIL Drill with geared chuck. Sand, polish, drill, buff, mix paint . . . all with the same SKIL Tool. You get all this:

Model 549 SKIL Drill with geared chuck . . . Drill Stand . . . Rubber Disc Pad . . . Polishing Bonnet . . . 5 Sanding Discs . . . 2 Arbor Adapters . . . Paint Mixer . . . Grinding Wheel . . . Wire Brush . . . Counter Sink . . . 3 Wood Augers . . . 13 Drill Bits . . . Wall Type Carrying Case.

LEARN ABOUT THE FUN SKIL TOOLS OFFER. SEE THEM AT YOUR HARDWARE, DEPARTMENT OR APPLIANCE STORE.

SKIL
BUILDERS TOOLS

Made Only by SKIL Corporation, formerly SKILSAW, Inc. 5033 Elston Avenue, Chicago 30, Ill. 3601 Dundas Street West, Toronto 9, Ontario. Factory Branches in ALL Leading Cities



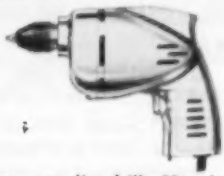
6" SKIL SAW
Model 526 . . .
Only $49.50.

All the exclusive SKIL features and the power of many professional saws. Sawing jobs become simple for you. Make kitchen cabinets, build a fence or finish the basement. Just look at these professional features SKIL offers:

- **6,100 r.p.m. powerful 8 ampere motor**
- **Trigger switch for right or left hand control**
- **Automatic safety guard**
- **Tilts to 45 degrees for bevel cuts**
- **Quickly converts to a bench saw**
- **Extra powerful A.C.-D.C. Universal Motor**
- **Rugged die cast aluminum housing**

Other models as low as $29.95

NEW ¼" SKIL DRILL
Model 535 . . .
Only $19.95.



Lowest price ever for a famous quality drill. Here is the greatest tool investment you could make. Power to drill through ¼" steel or ½" hard wood. Use it for hundreds of jobs, in the home, the garage or the basement. Look at these features:

- **Famous Keyless Chuck**
- **Hardened Steel Gears**
- **Powerful Motor**
- **Trigger-Type Switch**
- **Self-Lubricated Bearings**
- **Pistol-Grip Handle**
- **2500 r.p.m. Speed**
- **Only 3½ Lbs.**

Other models up to ½"

Please Him With the TOOL of 1001 uses

- GRINDS
- CARVES
- ENGRAVES
- ROUTS
- DRILLS
- SHARPENS

27,000 R.P.M.

DREMEL Moto-Tool "The Pocket-Size Machine Shop!"

Most powerful . . . most versatile tool of its kind! Works in wood, metal, plastics . . . does 1001 money-saving jobs. Proved in hundreds of industries, thousands of homes. Easy to use as a pencil (dynamically balanced for vibrationless operation and weighs only 13 oz.) Give him a Moto-Tool and he'll thank you for years to come! Choose from two complete kits—or buy Moto-Tool alone.

MOTO-TOOL No. 2
Kit contains 23 accessories including high-speed steel cutters in sturdy steel case, **$25.95**
No. 2 Moto-Tool only, with emery wheel point, **$17.85**

MOTO-TOOL No. 1
Kit contains 34 accessories (steel cutters, grinding wheels, polishers, etc.) in steel case, **$19.50**
No. 1 Moto-Tool only, with emery wheel point, **$10.85**

FAMOUS DREMEL MOTO-SAW A GIFT ENJOYED BY ALL AGES!

Cuts ¾" wood, tile, masonite, etc! Amazing foot-a-minute cutting speed!

A high-speed electric power tool with hundreds of household and workshop uses! So easy to handle, women and children love it—no better way to start a woodworking hobby! Amazing capacity—makes knickknacks, toys, small furniture pieces, other hobby projects. Has rugged reciprocating motor, only 2 moving parts, never needs oiling. Nothing like it at anywhere near its low price! A really thoughtful gift!

SEE YOUR DEALER. If he cannot supply, order direct on 5-day trial, money-back guarantee. Remit in full for postpaid shipment; or send $2 now, pay postman balance plus COD fee.

DREMEL MFG. CO Dept. M-125, Racine, Wis.

Speaker Hurls Voice Four Miles

Words spoken into this super loudmouth can be heard clearly up to four miles away. The speaker works like a human voice box, projecting sounds by valving a stream of compressed air. Stanford Research Institute developed it for the Signal Corps for beachhead direction and propaganda warfare.

Plane Folds for Road Trip

You could park this folding-wing plane in your garage and just tow it back and forth to the airport. Road-clearance lights are recessed in the wing folds. Ray Stits, Riverside, Calif., custom-builds the 150-m.p.h. two-seater for about $6,000.

Now!

Porter-Cable quality in this all new

finishing sander

only $39.50

Here's the great new finishing sander that's got *everyone* talking—with a price tag *anyone* can afford!

It's Porter-Cable's Model 145—and it's a honey! Use it for coarse, medium, and fine finishing on wood, metal, plastics, glass, and many other materials—do hundreds of sanding jobs faster and easier!

Orbital motion lets you sand with, against, or across the grain, with never a gouge or ripple. Husky Universal motor has all the speed and power you'll ever need—lightweight, *balanced* design prevents fatigue.

Best of all, this rugged new Sander is built to Porter-Cable's uncompromising *quality standards* – which means long life, trouble-free service, *value* far beyond its price. See and try it soon!

MODEL 145 — ONLY $39.50 COMPLETE

Precision ball and bronze bearings throughout. Standard 9 x 11 sandpaper size provides 4 abrasive sheets for the 145. Quick-change paper clamps, sturdy die-cast aluminum housing. Weight, 5½ lbs.

Porter-Cable

Quality Electric Tools

SEE YOUR DEALER — OR MAIL COUPON TODAY!

PORTER-CABLE MACHINE CO.
515-B N. Salina St., Syracuse 8, N. Y.

Yes, send me a complete catalog sheet on the Model 145 Finishing Sander, and the name of my nearest dealer.

Name_____

Address_____

City_____ Zone____ State_____

In Canada, write to Porter-Cable, Ltd., Box 5019, London, Ontario. Canadian prices slightly higher.

saws • belt sanders • finishing sanders • drills • routers • planes

New HASTINGS WEAR REDUCER

Guaranteed to do all 3 or Double-Your-Money-Back!

- **Make your engine smoother, quieter!**
- **Stop hydraulic valve lifter noise!**
- **Smooth out your automatic transmission!**

ADD A PINT TO ANY MOTOR OIL—H-W-R works with any brand or type preferred, including heavy duty and detergent oils.

WORKS IN ANY FULLY AUTOMATIC TRANSMISSION Add a pint to the transmission fluid to stop jar and jerk.

HASTINGS MANUFACTURING CO. • HASTINGS, MICH.
Wear Reducer, Casite, Piston Rings, Oil Filters, Spark Plugs

The New TVs Are Bigger, More Powerful
[*Continued from page 122*]

shimmering, rolling or tearing picture.

Sensitivity. How sensitive are the new sets? Some manufacturers report that their sets can make a usable picture from a signal measuring only eight microvolts per meter. Others report that a signal measuring 70 microvolts per meter—nine times as great—is required for a usable picture.

But what is a "usable picture?" Experts disagree. So the sensitivity figures given in the chart must not be taken too literally. Many manufacturers will not specify sensitivity for this reason.

Picture quality. Sensitivity gets you a picture. You want more—a sharp, detailed picture. How sharp and how detailed the picture is depends greatly on the intermediate-frequency (IF) amplifier and video-amplifier circuits.

Most '56 TVs have three IF stages and one video-amplifier stage, but more expensive chassis are likely to have four IFs and two video amplifiers. Almost all IFs now operate at about 40 megacycles frequency, which is less likely to be bothered by interference. But the 20-megacycle IFs can be just as interference-free, if properly filtered.

Filters and traps. A strong signal, such as police or ham radios, or an airway beacon, may ride into the IF amplifiers of your set if their frequency is near that of your IF frequency. This will be amplified along with the picture signal and ruin your picture. IF traps and high-pass filters in the antenna input stop this interference before it has a chance to get to the set. FM and IF traps are tuned to block specific bands of frequency, while high-pass filters cut out all frequencies below Channel 2.

One bottleneck that limits picture detail is band width—the frequency range that the IF and video circuits can handle. Band width varies all over the lot in '56 television sets.

The receiver band width should match the band width of the transmitted signal. This is set by the Government at a the-

[*Continued on page 252*]

MODERN LAWN MOWER SHARPENER

COMPARE BEFORE YOU BUY

Write for free booklet 11R

Start your own business—increase your income

Sharpens any mower in ten to twenty minutes. Handles complete assembly of all reel types including 36 in. power mowers. Handle, wheels, roller, and engine are not removed.

Oil remains in engine while sharpening. Bed knife sharpened in same centers — no attachments needed.

$263.00 F.O.B. PASADENA

MODERN MFG. CO.
160 N. FAIR OAKS, PASADENA, CALIF.

MAGNETS 225 lb. PULL

GENUINE ALNICO—NEVER WEAKENS

AMAZING, PERMANENT MAGNETS—WILL NOT WEAKEN! NON-ELECTRIC
Retrieve guns, tackle, tools and other steel items from lake, river, plating tanks, drains or other hard-to-reach spots. Recover drills, taps, etc. from sweepings. Clear alley of harmful tacks, nails. Many other uses. Pays for itself quickly. GUARANTEED. Try any magnet one week. Money refunded if you are not well pleased.

No. S-725 (Weighs 54 oz.) Has pull of 225 lbs. on steel block $15.00
No. S-625 (Weighs 70 oz.) Has pull of 125 lbs. on steel block $ 8.50
No. S-575 (Weighs 18 oz.) Has pull of 75 lbs. on steel block $ 6.00
No. S-500 (Weighs 13 oz.) Has pull of 50 lbs. on steel block $ 4.00
No. S-101 U-Shaped Magnet (Wt. 2¼ oz.) Pull of 6½ lbs. 2 for $ 1.50
No. S-30 Hobbyist assortment of five small magnets . . . . . $ 1.00
No. S-48 Powerful Hot Pad Magnets. 8 for $1.00 . . . 30 for $ 3.00

Send Money Order or check. We pay postage. No C.O.D.'s.

MIAMI MAGNET COMPANY, 3240 N.W. 27th Ave., Miami 42, Fla.

WELD BRAZE SOLDER CUT

4 WAY ONLY $14.75 f.o.b. factory WELDER

Complete with Twin Carbon Arc Torch and accessories . . . to handle all metal-craft work.

Acclaimed by thousands of Homeowners, Mechanics and Hobbyists as the welder of 1001 uses. Easily operated from properly wired 110 volt AC or DC line. **The ideal gift with a life-long use . . .** Order today on 10day money back guarantee.

FOUR-WAY WELDER CO., Dept. F3-N
1810 S. Federal St. • Chicago 16, Ill.

A PRECISION LEVELING INSTRUMENT for only $12.95

With the New LEVELALL one man can do the work of two men and a transit, quickly, easily, accurately. All alone you can speedily level points for footings, forms, piping, batter boards, sills, lintels, floors, ceilings, roads, driveways, lawns — any type of construction work. Send for Free booklet or, better yet, order a DeLuxe Levelall today.

*Name*_____
*Street*_____
*City*_____ *Zone*____ *State*_____

☐ Mail 75' DeLuxe Levelall @ $12.95 ☐ Regular 50' model @ $9.95 ☐ Ship postpaid full price enclosed
☐ Ship C.O.D. Money-back satisfaction guaranteed.

LEVELALL 81-L Webster Street, Rockland, Mass.

FINEST WOOD LATHE in *Atlas* HISTORY

New bed is heavier, has ground ways.

One movement of lever loosens tool support for instant positioning, or anchors it to bed.

NEW FUNCTIONAL CABINET STAND

The new ATLAS 12" is a heavy-duty lathe built for professional workmanship and efficiency in the *complete range* of turning operations . . . inboard and outboard . . . light or heavy.

Has new massive bed with *ground* ways. 60-hole indexing mechanism. 4 speeds. Lever-controlled bed locks. Sealed-for-life ball bearings.

And what a stand . . . a completely new cabinet design . . . a massive foundation for accurate work, with 7/16" steel plate construction, thick wood top, enclosed V-belt drive. Your shop isn't complete without this fine lathe. Write for literature.

Headstock spindle is turned from a solid bar of tough, fine-grained steel, accurately ground. Sealed-for-life ball bearings take all radial and thrust loads and are preloaded at factory to eliminate spindle play. Top is hinged to make belt changing easy.

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Distinctive projects for everyone — letter rack, knife holder, bar stool, cocktail table, table lamp, etc. 32 pages. Size 8½" x 11". Price 50c (65c outside U.S.A.)

ATLAS PRESS CO.
12-25 N. Pitcher St., Kalamazoo, Mich.

Please send catalog showing wood lathe. Enclosed is $_____ for 20-Plan Book.

Name_____
Address_____
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[Continued from page 250]

oretical maximum of 4.0 megacycles for video information, but is never actually that high. If the receiver band width is far below the theoretical figure, however, it will probably block some detail that is in the transmitted picture.

Transformer or no? The lack of a transformer will not matter to viewers who leave all servicing to a technician.

But it may matter to those who have become adept at putting their own sets in order by the try-a-new-tube technique. Most transformerless sets have their tube filaments wired in series, like the older Christmas-tree lights. If one filament burns out, the whole set goes dead. There will be nothing on the screen to give a clue to the faulty tube, and the old stunt of feeling tubes to locate a cold one will not work either, since they will all be cold.

Some basically transformerless sets get around this by using a filament transformer with the tube filaments wired in parallel: If one tube fails, you can find it because the others remain lit.

If you operate any transformerless set with the back removed for repair work, you risk a more serious electric shock than you would by working on a transformer-equipped one. The chassis and other metal parts are hot, connected to one side of the power line.

Sound. The day when you had to be satisfied with an audio system that sounded like a $9.95 radio is past. Cheap table models still have small speakers, but even they are bigger than they used to be. Consoles frequently have two or three. And nearly every maker has TV-radio-phonograph combinations with high-quality sound systems. Magnavox, for example, offers as an option with any TV chassis a separate record player-radio that uses a 10-watt push-pull audio amplifier. All but the smallest, cheapest sets have some provision for receiving the new UHF stations. END

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SIR WALTER RALEIGH'S BLEND OF CHOICE KENTUCKY BURLEYS IS EXTRA-AGED TO GUARD AGAINST TONGUE BITE. XMAS WRAPPED... IT MAKES A PERFECT GIFT.

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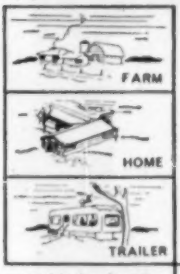

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Not even a $100 Portable Saw has a dado cutter! "Arco-Saw" (guaranteed to fit **any** ¼" electric drill) with sensational new "Dado-Arbor" adjusts easily to cut any size groove up to 1⅛" wide x 1" deep in **ONE CUT!** Graduated **Depth-Bevel-Rip Gages** adjust for depth of cut up to 1⅜", angle cuts to 45°. Amazing swivel action of "Dado-Arbor" (see sketch above) cuts large grooves cleanly and accurately with little power. "Dado-Arbor" is easily removed to use the saw for straight ripping, crosscutting or angle cuts. Right angle steel gear drive and safety-yoke permit ONE HAND operation. Includes quick-cutting 5" **Safecut Blade.**

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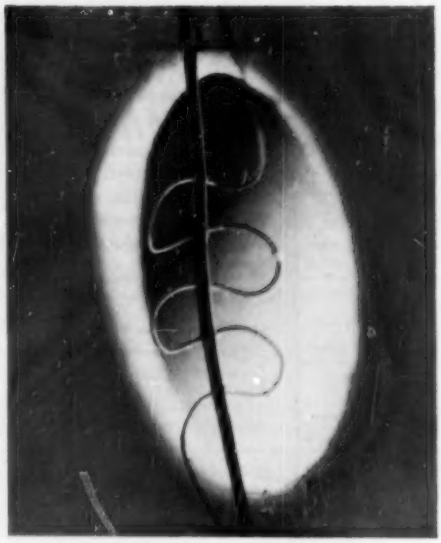


Tool Drills Microscopic Holes

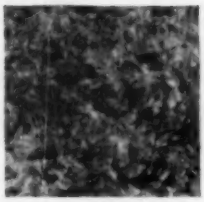
THAT thick strand above is a human hair. Through it a microscopic strand of .001-inch wire has been threaded. A one-mil drill too small to be seen by the naked eye made the holes. GE instrument makers performed the stunt to show their facilities for drilling minuscule apertures.

"Hot" Food on Way to Bugs

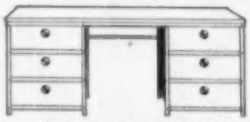
THESE concrete drums of hot stuff are leaving Britain for Africa to help cut down disease in cacao trees. Mealybugs, pests that infect the trees, will be fed the radioactive material and released so they can be traced and their feeding habits studied.

A new material for home craftsmen...NOVOPLY!

Versatile extending coffee table, #452 (50c)



Record storage cabinet, #436 (50c)



Sewing table-desk, #543 (50c)

Handsome, textured NOVOPLY gives "fine furniture" look, is low in cost, works easily with all tools

Now build your own beautiful furniture with Novoply, the new do-it-yourself material that costs about the same as ordinary fir plywood.

Easy-to-work Novoply is smooth and flat, good both sides, has no grain direction to worry about. Its warp-free qualities make it perfect for sliding doors, drawers, cabinets, table tops. Novoply looks well natural or stained; comes in many sizes, in ⅜" and ¾" thicknesses, in pine and in California redwood.

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Use Novoply to make 3 projects shown! Send coupon today for famous Easi-Bild* Patterns and get Easi-Bild's big catalog—shows over 200 handsome pieces you can make. Patterns give step-by-step illustrated instructions—take the guesswork out of build-it-yourself.

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- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3½ in. deep, tilts full 45 degrees
- Floor model 34" high, table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run.
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GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jackscrew mechanism and handwheel, and all other metal parts (less blade) $22.95
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- Cuts to center of 21 inch circle
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GIL-BILT Metal Parts Kit includes Plans, rubber tires, aluminum wheels, ⅝ in. blade, ball bearing spindle, tilt mechanism, blade guides, table tilt segments, and all other metal parts.....$23.95

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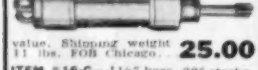

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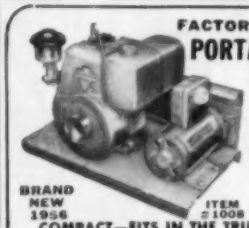

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700 WATT—GENERATOR SET—same as above, slightly smaller—with Briggs-Stratton Engine—Model 708—F.O.B. Chicago **129.50**

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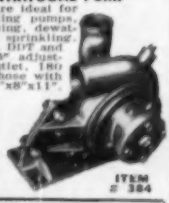
U. S. NAVY ALL BRONZE CENTRIFUGAL PUMP

These all bronze Centrifugal Pumps are ideal for use as marine bilge pumps, circulating pumps, fire protection or irrigation, car-washing, dewatering, basement sump pumping, lawn sprinkling. Will pump water, oil, brine, gasoline, DDT and sulphur compounds. Equipped with 6" adjustable "V" pulley, 2" dia. inlet and outlet. 180 GPM capacity. Inlet and outlet take hose with 2¼" inside diameter. Dimensions 11"x8"x11".

Total head-feet	Speed	H.P.	GPM
25	3600 RPM	3	180
35	3000 RPM	1¼	90
20	2400 RPM	½	75

Back plate may be rotated for most convenient inlet position. Shipping weight 31 lbs. Govt. cost 96.00. F.O.B. Chicago . . . **29.50**



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ROTARY PUMP

Item #104A — A fine pump for gasoline, fuel oil, water, kerosene. For fuel transfer, sump pumping, for draining basements. Capacity, 400 gallons per hour. ¾" pipe thread inlet and outlet. Has built-in, adjustable relief valve, set at 30 P.S.I. Adjustable to 100 P. S. I. Rotation in either direction; use ⅛ Hp. motor; ½" standard shaft, ball-bearing supported. Dimensions: 5½" x11½"x10". Shipping weight 8 lbs. A r35.00 VALUE F.O.B. Chicago **16.50**

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12 Volt Electric Motor

● For electric wheel chairs (P.O.O. Mech. design—idar.-'53).

● For electric golf carts.

● For self-propelled scooters, childrens midget cars.

ITEM NO. 308

Rated 1 H.P.,— 100 amps., 5600 R.P.M., 12 volts, D.C. — This double shaft motor of ball-bearing construction may be run on 8 volts for lower horsepower requirements. —Standard ⅝" shafts, nut and bolt electrical terminals, flange mounting.—Dimensions: 9" x 4½" x 4½" Ship. wt. 19 lbs. A real value at . . . . . F.O.B. Chicago **12.50**

BELT DRIVEN

A. C. GENERATORS

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Ideal for powering electric tools, oil burner, refrigerator, lights, or other appliances requiring up to 700 watts of power. **700 WATTS,** 115 Volts, 60 cycles A.C. 3600 R.P.M. Compact, self-regulating generator with V Belt pulley and double outlet receptacle. Rotation counter-clockwise. May be driven by tractor or auxiliary gasoline engine. Requires 2 HP minimum. Dimensions: 10" long x 8" high x 6" wide. Shipping wt. 27 lbs. F.O.B. Chicago **59.50**

Model 1010, 1000 WATTS Same as above. F.O.B. Chicago **79.50**

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Model PG-12 sharpens, joints, gums, and retooths all cross cut, rip, combination, miter, and planer blades up to 12" in diameter. Two precision index plates give versatile, accurate sharpening. Guarantees precise spacing of teeth. New safety rest prevents tilting and gouging of blade. Save time and money. Special $3.00 grinding wheel also included for use on your own power table. Fits regular or radial swing tables.

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QUICK-WAY SAW CO.
100 Hornby Drive, Painted Post, N. Y.

BELT SANDER

for

Wood, Metal, Plastic

You will find this the handiest machine in your workshop. Standard 3x24 Belt. List Free.

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Make $20 to $30 a Week

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MACHINE SAW FILING

PAYS UP to $3 or $5 an HOUR

• Turn your spare time into CASH—sharpening saws with a Foley Automatic Saw Filer pays up to $3 or $5 an hour. You will find you can make $20 to $30 a week in your spare time as a starter.

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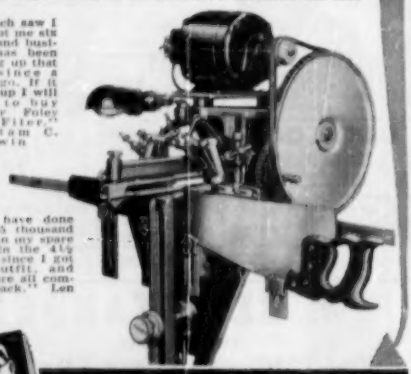
"Each saw I filed got me six more and business has been picking up that way since a year ago. If it keeps up I will have to buy another Foley Saw Filer." William C. Baldwin



"I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back." Len Crego

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Air-Raid Truck Puts Out Fires

REMEMBERING its bombed cities, West Germany's civil defense organization has come up with a water-tank truck that can plow through pitted and rubble-covered streets to a blaze. It carries several high-pressure pumps and an assortment of hoses.

Dust Sculptures Wilted Walrus

THIS melted, mournful-looking creature is neither man nor beast, but a piece of commonplace machinery that has just taken a beating. The photo shows a small GE electric motor after completing a 230-hour "dust test." Despite its sad appearance, the motor was still humming happily.

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- 4" jointer-planer with 3/8" cut, 4"x26" table and flexible guard
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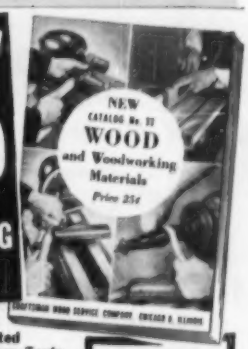

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Oldsmobile Hops Up That Engine—Again

[Continued from page 148]

The national average octane for regular gas during the month of September, 1955, was 88.8. That for premium gas was up to 96.

While the quality of the gas was going up, the automobile manufacturers proceeded to build "mechanical octanes" into their engines.

Valves are bigger. They rise higher off their seats. They "dwell" longer—stay open for a greater length of time. Bores are wider, but strokes remain about the same, year to year. That boosts the "mechanical efficiency" of an engine—it wastes less energy on its own friction.

Engines are "ventilated" better. ("If anyone had told us as late as four years ago," remarked one power-plant man, "that we could ventilate an engine as we're doing today, we'd have thought he was crazy.") Carburetors are bigger. Intake and exhaust manifolds are larger. Compression ratios, of course, steadily go up. Olds' for '56 is at 9.25:1.

Piston rings leak less gas into the crankcase on the power stroke. Combustion chambers are smaller. Engine-head temperatures (the usable heat) are higher. And when the exhaust valve closes, there is less residual burned gas left in the cylinder.

Olds had its bloopers. These began popping up months before the 1949 engine appeared in auto showrooms.

The bottom faces of the hydraulic valve lifters got scored and pitted on the steel cam being used. The metallurgists did a second take, replaced the steel cam with one of cast iron and gave the lifter a chilled alloy iron body. That fixed that. The whole industry copied it.

Cast-iron rings got worn, and leaked as compressions went up. Chrome plating mended that. The push rod on the fuel pump, mounted at the top of the engine, got hot, expanded, rubbed, and starved the cylinders. They relocated the pump.

[Continued on page 274]

GIGANTIC SAVE-TO-70% **MAIL SALE** WAR SURPLUS EXCESS INVENTORY BANKRUPT STOCK

ARMY POWER PLANTS

- Marvelous buys in new condition Govt. surplus plants and generators. We pay freight!
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- Leading make. All bronze ball bearing hi-capacity. Complete with pulley. 1½" inlet, 1¼" outlet. ● Will pump up to 140 GPM. Pressures to 65 ft. Suction lift to 18 ft. Gov't. Cost $65.50. Prepaid. **$24.61**

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- **Control Valve,** For single or double acting cylinders. Sale. . . **$17.98**
- **Pressure Gauges,** 1000 lb., 1500 lb., 2000 lb. **$3.49**

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- **$30 Electronic Experimental Kit** . . . **$4.98**
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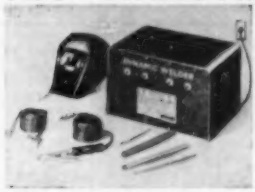

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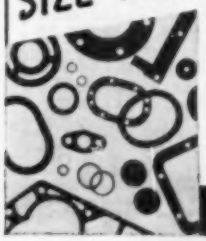

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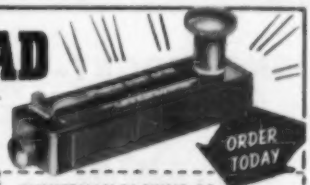

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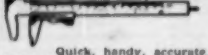

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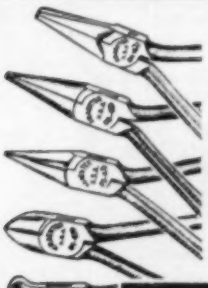

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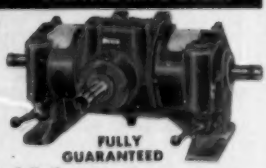

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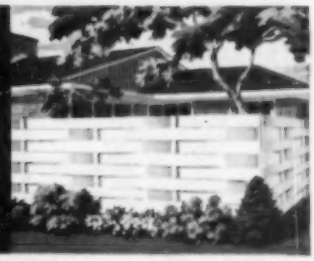

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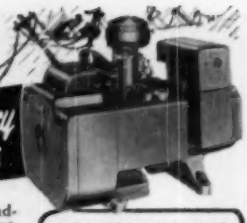

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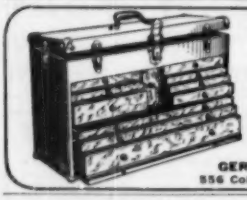

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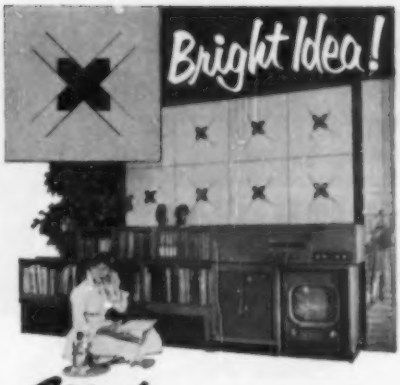

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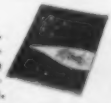

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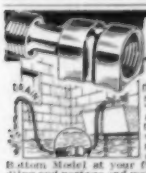

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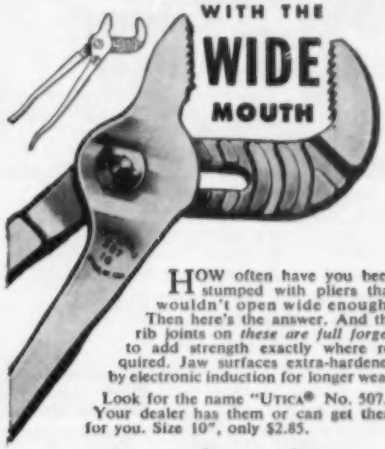

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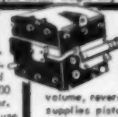

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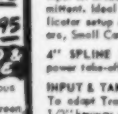

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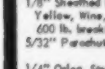

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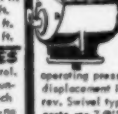

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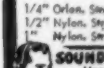

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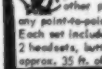

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Minimum order 2 sheets	Min. order 6 sheets	Min. order 4 sheets

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Oldsmobile Hops Up That Engine—Again
[Continued from page 260]

Distributor drive shafts snapped. They beefed them up, altered their alloy content and gave them better bearing support. Engine blocks distorted. They strengthened the block reinforcements.

Plugs fouled at low speeds. This was a real poser. They thought the trouble was faulty valving, and even made glass cylinder heads to study it. But the solution was almost simple-silly. It turned out that when the gaps in the rings got aligned, oil from the pan squirted straight into the head. So they put a burr on the oil ring to catch in the drain hole of the groove. That kept the ring from rotating.

The real problem, with increasing compression, was valves. It still is, for everybody in the business. Olds had to go to silicon-chrome intake valves for '56 to withstand the heat. Exhaust valves are made of a nickel alloy.

Moreover, valves can't be run too dry. They wear. The stems deform. The stems must have an oil-vapor bath. Yet valves have to be sealed well, else oil runs down the stems into the cylinders.

Today, like everybody else in the automobile-manufacturing business, Oldsmobile has higher compression, higher torque, higher horsepower and better performance. If you ask the company why it has done all this at the expense of throbbing headaches, you will be told that it's on account of competition, mostly.

The record is an affidavit. The Olds people were content with the original 135 horsepower in the new V-8 through 1951. Until then they had nobody on their tail.

There are other reasons for ever-increasing power. One is weight. In 1949 the engine in the Olds "88" toted 3,900 pounds of car over the road, including the few accessories. In 1956 the engine is burdened with 4,500 pounds of multi-accessoried car. A lesser reason is the power losses in such things as air conditioners, power steering and automatic transmissions, amounting perhaps to less than 20 horsepower.

How much more power this engine will yield in the future is a question that nobody will wager on, least of all the engineers. Based solely on compression-ratio arithmetic since 1949, it conceivably could be made to give up more than 400 horsepower at the 12.5:1 ratio built into Ket's experimental engine.

There are ifs—*if* the block could take it, *if* better valves were designed, *if* the petroleum industry could supply the diet—and if the nuts are kept on the automobile and out from behind the steering wheel.—*Devon Francis.*

NEXT MONTH . . . **How to Choose a Geiger Counter**

THINKING of buying a Geiger counter for uranium hunting? Which of the dozens that are on the market, with all kinds of gadgets and price tags, will serve you best? In the January issue of POPULAR SCIENCE MONTHLY, an article on how to choose a Geiger counter will offer expert advice to guide you when you go shopping. From practical experience the author, Griff Borgeson, compares the features of current models and tells which are most desirable—and why.

PORTABLE LIGHT PLANTS

1300-1500 WATT PLANT 115v. 60 cyc. AC Push Button Start. Powered by a 3½ HP. Clinton engine. Combines big output with easy portability. Provides emergency power for operating any oil burner, sump pump, freezer, television, lights, communications systems, etc. which require up to 1500 watts. (Item 22). Wt. 110 lbs. Reg. $475 value, Factory price... **$239.50**

1750 Watt Plant Powered by 4.5 Briggs engine. Electric starting & battery charging built-in! Factory price.. **$279.50**

MASTER-LITE 2500 Watt Plant

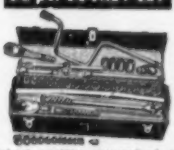
(Item 21)

110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 HP Briggs engine, complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 225 lb. Reg. price $645.00 (Item 21) Factory Price **$329.50**

3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33⅓ more capacity. Wt. 270 lbs. Reg. $760. Factory Price.....**$379.50**

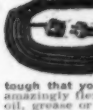
DUAL VOLTAGE 110/220 for any of above plants—$30 additional

52 pc. SOCKET SET



Highest quality, guaranteed nonbreakable sockets made by Husky. Beautifully matched chrome thin wall alloy absolutely the best. Contains a complete set of 28 sockets in ¼" drive, ⅜" drive and ½" drive, plus [illegible] necessary extensions, handl[illegible] speeders, reversible ratchets, e[illegible] all uncond. guaranteed against [illegible]akage. A beautiful set of tools [illegible] will handle any job; in a big doghouse steel box. Wt. 17 lbs. (Item 265) List price $62.90. Factory Special..... **$27.95**

EXTENSION CORD



100 ft. extra heavy duty, made of specially insulated No. 14-2 conductor wire, neoprene covered. (So tough that you can drive a truck over it), yet amazingly flexible and easy to handle. Resists oil, grease or water—use indoors or out. Complete with heavy rubber plug and outlet. Wt. 9 lbs. (Item 185) Usually $15. Special 100 ft..... **$8.95**

No. 10-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 9 lbs. (Item 502a) **$10.45** 50 ft. without fittings (Item 502) ... **$9.45**

NO. 12-3 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lbs. **$6.95**. 100 ft. (Item 200) ... **$12.95**

JET STEAM MASTER

Now, a super efficient portable steam generator that produces live steam at 100 lbs. pressure in 60 seconds from a cold start! Produces large volume of high pressure steam on 2 pints of fuel oil. Instantly cleans sticky grease, dirt, rust, old paint, etc. off implements and road machinery. Pays for itself in a few weeks. Sterilizes soil. Sterilizes as it cleans—milk equipment, etc. Fully automatic—oil fired with new, built-in lifetime bronze water circulating pump. Draws water from faucet or bucket. Simple and safe—anyone can use it; built-in safety valve. Complete with 12 ft. of hi-pressure steam hose and new triple efficiency steam gun that automatically mixes in soap solution if desired. Wt. 250 lbs. Item 463. Special factory price..... **$329.50**

9th MASTER MECHANIC'S BEDROCK FACTORY PRICES

600-700 WATT PLANT

(Item 24)

PUSH BUTTON START

115 v. 60 cyc. AC Powered by a rugged 2 HP. easy starting Briggs engine. No wiring necessary: just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Regular $275.00 value..... **$143.50**

1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output..... **$199.50**

LESS THAN WHOLESALE

GIANT 2000-2500 WATT PLANT

110-120 v. 60 cyc. AC, absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb. Reg. price $585. Special at..... **$299.50**

Same plant with electric self starter (Item 31a)..... **$359.50**

Generator only and control box.... **$169.50**

DUAL VOLTAGE 110-220 available on any of above models for $28.00 additional.

Hi-LINE 6000 WATT PLANT

(Item 162)

PUSH BUTTON START

115/230 v. 60 cyc. AC. A brute of a power plant with a rugged 14.6 hp Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 350 lbs. Easily worth $995. With crank start. Factory price. **$585.50**

Same plant but with self-starter **$645.00**

Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. (Item 163) Factory price..... **$345.00**

We make every type and size of light plants—Write, giving us your requirements!

MASTER MECHANIC'S DC ARC WELDERS

Built in our own factory, these big, industrial capacity, portable welders provide terrific performance, yet are sold direct-to-you at bedrock factory prices—hundreds of dollars less than you'd expect! Senior model (shown in illustration, left) has high capacity DC welding unit—easily welds any thing up to 2" plate using 1/16" to ¼" rods. Built in stabilizer and cooling system makes arc easy to strike and hold. Dual control rheostat provides low heat soldering, brazing, and welding from 30 to 300 amps. Comes complete with instructions, guarantee and triple V-belt or flat pulley. Easy to hook up and easy to operate.

WELDER ONLY — DUAL CONTROL MODEL. Same as above—drive with your tractor, jeep or gas engine of 14 HP or more. (Item 38a). Wt. 110 lbs. $450 value **$99.75**

WELDER ONLY—STANDARD MODEL. Same as above but with single rheostat for heavy metal welding only (Item 38). Wt. 110 lbs. $400 value. Special . **$99.75**

COMPLETE POWER MASTER. (Illustrated at right) powered by a 14.6 hp., air cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compares with welder costing $1200. Factory Special..... **$449.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at. **$10.50**

THE POWER MASTER

(Item 280)

JET FLOW BLOWER

Tremendous air movement (1800 CFM) and great operation make this double inlet 10" turbine blower unbeatable for heating, cooling, drying and air conditioning. Ideal for attic or barn ventilation, converting gravity heating to forced air; spray booth exhausts, etc. Operates with any ¼, ⅓ or ½ HP motor. Oversized, long life bearings. Includes variable speed motor pulley and belt. Dimensions 19" hi x 18" x 16½". Outlet opening 13" x 11¾". Wt. 45 lbs. Item 245. Reg. $54.50. Factory Special..... **$29.50**

HEAVY DUTY ¼ HP motor for above blower..... **$17.95**

12" TURBINE BLOWER Similar to above, but larger with 2400 CFM capacity. Wt. 65 lbs. (Item 245a) Reg. $70.00. Factory Spec. **$34.75**

Variable Speed Selector

(Item 68)

Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Employs reliable "trouble free" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: ½-1 hp. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs.; Reg. list $228, $252 and $352. Our prices **$79.50, $89.50 and $114.50**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful continuous duty motor. 110-120 v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super efficient fan moves huge volume of air. (400 to 600 c.f.m.)

8" Pipe, wt. 5 lb.	$6.95
9" Pipe, wt. 6 lb.	$7.95
10" Pipe, wt. 7 lb.	$8.95
12" Pipe, wt. 9 lb.	$9.95

HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc.

10" Fan, wt. 8 lbs. (Item 10E)	$11.95
12" Fan, wt. 10 lbs. (Item 10D)	$12.95

CONDITIONAIRE VENTILATING FANS

Save big money installing your own exhaust fan. Efficient propeller type blade moves huge volume of air quietly and effortlessly. Heavy welded frame — pre-drilled for easy installation. Just cut opening and bolt in place. Continuous duty motors. Ideal for attics, restaurants, garages, barns, chicken houses, etc. Control manually or with thermostat.

Blade Opening	CFM	Wt.	Item	
16"	18¼"	2925	19 lb.	365a	$27.95
18"	19¼"	3600	27 lb.	365b	$31.95
20"	21¼"	4100	30 lb.	365c	$39.95

THERMOSTATS: BARN type (range 40°-60°). Wt. 2 lbs. $6.95.

9 TON HYDRAULIC PRESS

A tremendously powerful hydraulic press, capable of exerting 18,000 lbs. pressure. Pays for itself many times over—straightening bent connecting rods, king pins, crank shafts, axles, link pins and bars — or pushing out frozen bearings and bushings. Developed pressure under precise control and visible at all times on accurate gauge. Complete with both large and small anvils and jigs to straighten any kind of curve or bend. (Item 464). Wt. 110 lb. Actual list price $365. Our special close-out price..... **$69.50**

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SOUTH BEND 14½" LATHES

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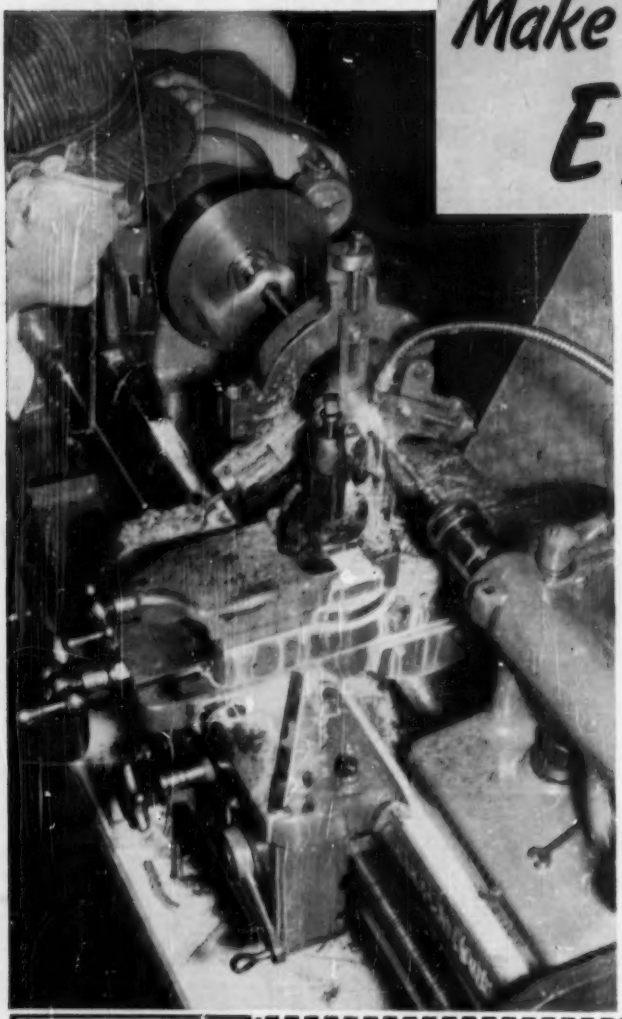

When tolerances start slowing up output, then is the time you need South Bend 14½" Lathes. Many plants have found they can save manhours and material by running the tough operations on these precision lathes — this is the type of work they do best. Their versatility enables you to keep them busy on a wide variety of work with a minimum of set-up time. Many attachments are available for special classes of work. Find out now how these lathes can give you efficient machining — *mail the coupon below today.*

BASE PRICE $1809

SPECIFICATIONS

SWING: 14⅝" over bed and saddle wings; 10¼" over saddle with chip guard removed.

BED LENGTHS: 5, 6, 7 and 8 feet.

DISTANCE BETWEEN CENTERS: 24⅛ to 60⅛ inches.

COLLET CAPACITY: 1 inch.

SPINDLE BORE: 1⅜ inches.

SPINDLE SPEEDS: Eight . . . 30 to 875 r.p.m.

POWER LONGITUDINAL FEEDS: 48 R.H. or L.H., .0015" to .0841".

POWER CROSS FEEDS: 48, .0006" to .0315".

THREAD CUTTING: 48 R.H. or L.H. pitches, 4 to 224 per inch.

CROSS SLIDE TRAVEL: 10 inches

Compared with our costs
OUR PRICES ARE LOWER
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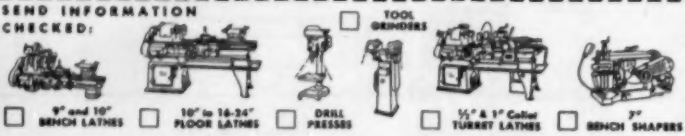

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ TOOL GRINDERS ☐ ½" & 1" Collet TURRET LATHES ☐ 7" BENCH SHAPERS

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Ideal Gifts For Hundreds of Homecraft Jobs

This **POWER SANDER AND POLISHER** puts satin-smooth finishes on new wood in just a few effortless minutes; sands down old paint fast and easily; feathers dry-wall seams perfectly; and polishes waxed surfaces to a handsome, high gloss. With 14,400 power strokes a minute the Weller Sander is almost impossible to stall. *25 square inch sanding area* is twice that of comparable tools; *straight-line action* sands with the grain, goes all the way into corners. Low design, *less than 3" high*, goes under low places.

WELLER POWER SANDER $14.95

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COMPLETE SOLDERING SET includes everything needed for joining metal parts, making electrical connections, sealing leaks and seams. *Weller Soldering Gun* heats in 5 seconds, has triggermatic control and 2 spotlights; *Wire Brush* cleans parts to be soldered; *Soldering Aid* makes tight wire twists; with famous *Kester Solder* . . . all in a handy storage case. Ideal too, for model railroading and other hobbies.

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